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ISSUE 180 NOVEMBER 2007

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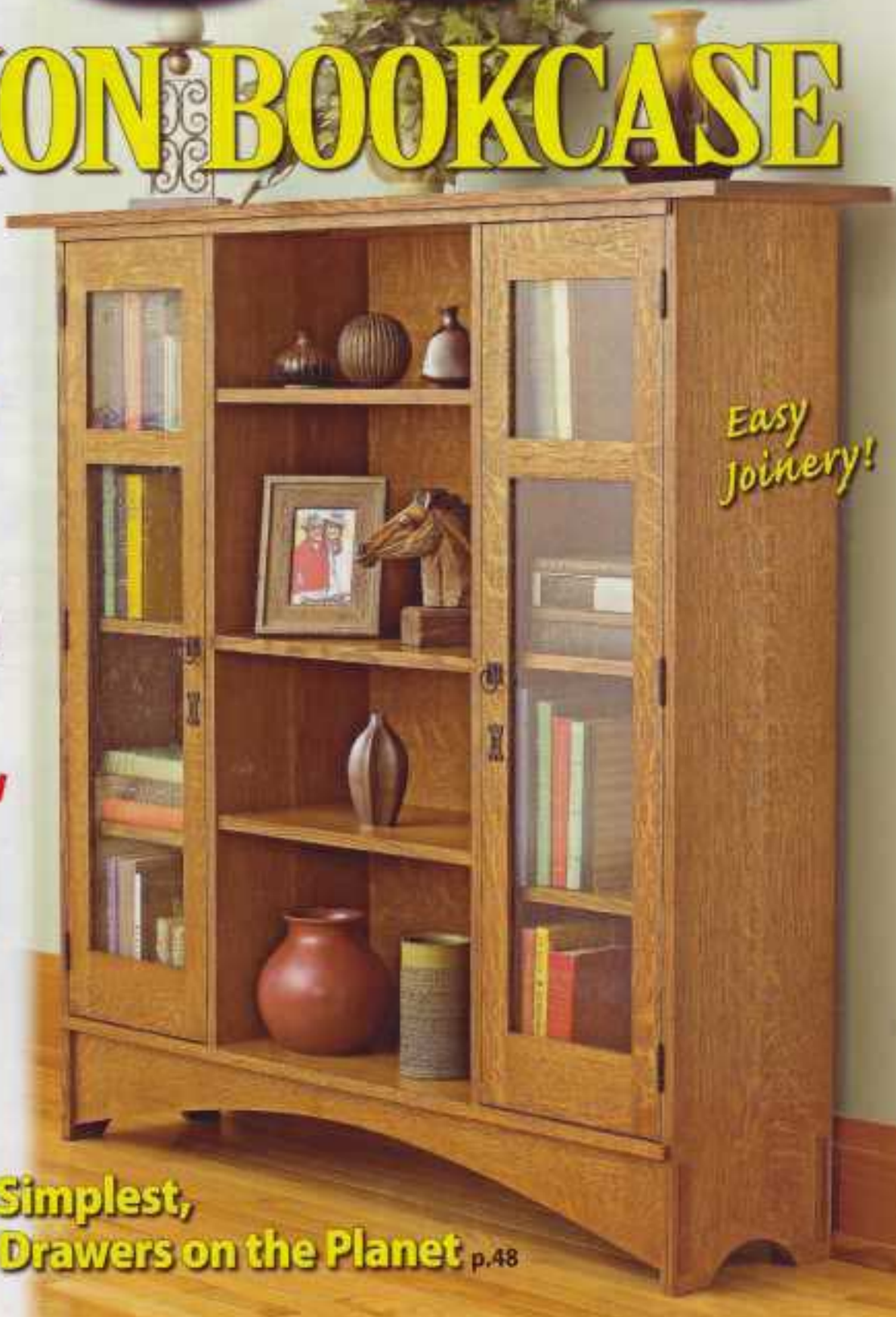

Easy Joinery!

Buy Smart! 26 Tools Tested & Rated

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Trick Out Your Tablesaw for Peak Precision p.16

Quick and Elegant: All-Wood Ceiling p.36

Build the Simplest, Sturdiest Drawers on the Planet p.48

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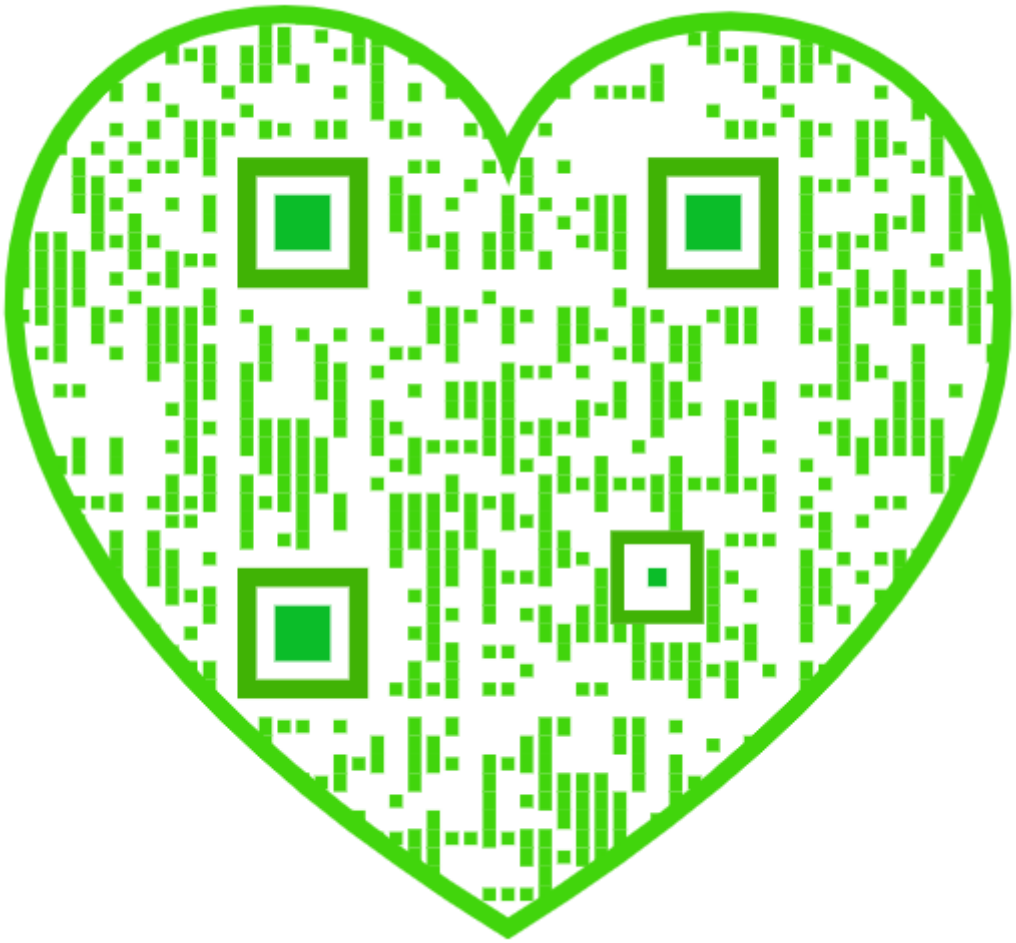

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SWAP YOUR SHOP SHOTS

How can a guy get any work done in here?!? Larry Schwager of Jerome, Idaho, just built his first woodworking shop, *below*, and he posted photos of it at woodmagazine.com/shopshots in the Idea Gallery. See more photos or post your own!

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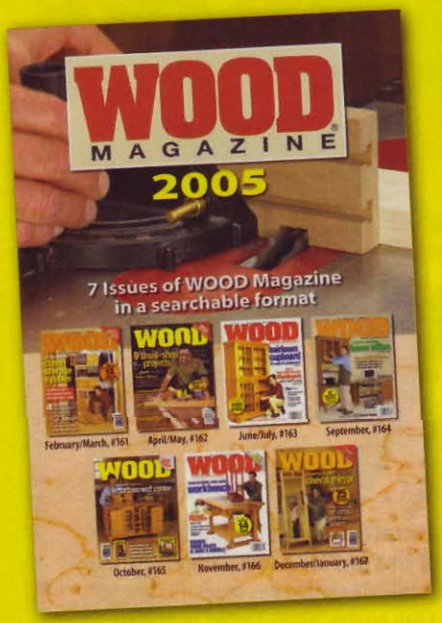

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Better Homes and Gardens®
WOOD®

November 2007 | Vol. 24, No. 6 | Issue No. 180

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BILL KRIER

Owen recently made picture frame bookends, a vase, and a jewelry box as gifts.

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Bob designed and built a pair of cherry sofa tables.

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Technical Consultants **JEFF HALL, PAT LOWRY**
Contributing Craftsman **JIM HEAVEY**
Proofreaders **BABS KLEIN, IRA LACHER, JIM SANDERS**

Last Valentine's Day, Jeff surprised his wife with this mission rocking chair.

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Editor's Angle

Making it easy for you to find past articles

You've been there—the grocery store checkout line where you're asked: "Paper or plastic?" I typically opt for paper, knowing I can reuse the paper sack for any number of shop purposes (such as a kraft backing for picture frames). But faced with a similar question: "Paper or Internet for an index of past *WOOD*® magazine articles?" I opt for the Internet.

Why? The advantages of putting the index onto our Web site are so powerful (I'll describe them in a bit) that I haven't given much thought to putting an index into the magazine since we last published one in 2000. But a recent meeting I had with a group of woodworkers convinced me that I need to discuss this subject here.

It started with a focus group

From time to time, we sit down with a group of woodworkers to find out what we're doing right in the magazine and what we could be doing better. On one such occasion, members of the Des Moines Woodworkers Association told me how much they missed having a paper index. And truth be told, we get the same comment from a lot of other readers who write or e-mail us.

Obviously, we need to do a better job of letting you know that our online index does exist and informing you of its benefits.

To find the online index, simply go to woodmagazine.com and click on the "Article Index" box in the upper left of the page. You'll go to a search-engine page where you enter a word or two describing the article you want to find. For best results, follow these tips:

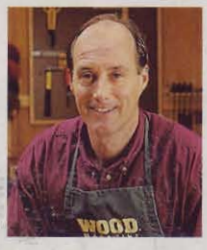
First, enter *one* word that describes, in a general way, the article you are looking for. (To make the index work, we "mark" each article with an average of 18 words that best describe its contents.) If you enter one of those "marked" words, the article will show up in a listing. For example, if you're trying to find a Shaker-style bed project, simply enter "bed" in the search field. A Shaker-style bed will show up in a listing of other bed-related articles. Enter two words, say "shaker bed," only if the listing you get with a single word is too long.

One more tip: Make sure you've spelled the search word correctly. The search engine won't ask you "Do you mean rabbet?" if you're looking for tips on rabbet joinery but enter the word "rabbit."

Why an online index makes so much sense

The biggest limitation of a paper index: It becomes obsolete as soon as the next issue of the magazine comes out. The online index is always up to date, with articles from issue 1 (October 1984) through today. Including this issue, the online index searches more than 3,000 articles, so you don't have to wade through multiple annual indexes to find an article. And, if you don't have the issue that the article appeared in, the online index often tells you how to obtain that article.

Finally, our online index doesn't eat up valuable pages in the magazine—pages that instead we are able to devote to more projects, tips, tool reviews, and the other coverage you enjoy so much in each issue.



If you haven't used the online index lately, go ahead and try it. I think you'll like it.

Bill Krier

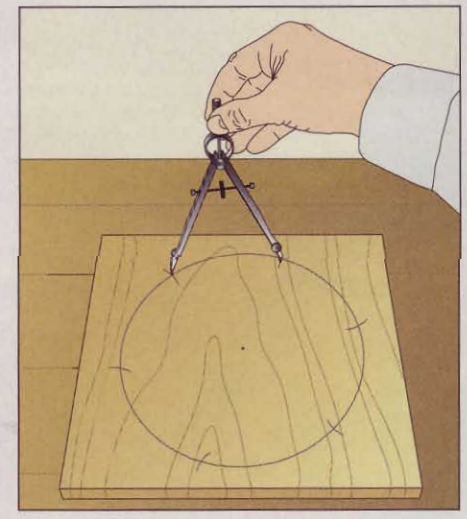
Sounding Board

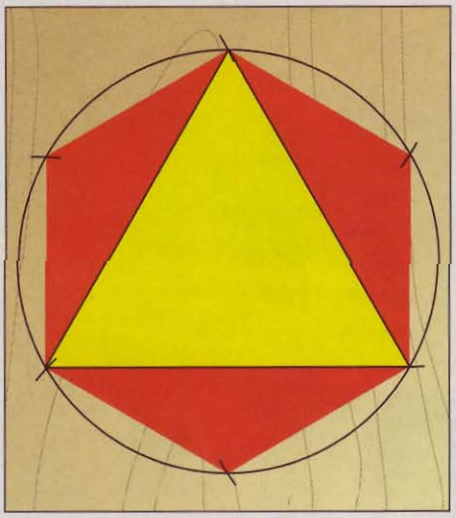
Our bulletin board for letters, comments, and timely updates

Simple geometry pinpoints a speedier way to locate table legs

While reading your article on how to build the three-legged plant stand in issue 175 (March 2007), I remembered a quicker way to lay out the locations for the legs on the top ring and shelf. (I found the idea while helping my daughter with her geometry homework.) Here's how it works: Draw your circle with a compass. Without adjusting the compass, make a beginning mark anywhere on the circle, position the compass point on that mark, and then draw a short arc that intersects the circle. Move the compass point to that mark and draw another intersecting arc. Repeat until the last mark intersects the first, as shown at *far left*. You now have six equidistant points, from which you can choose three (as shown with a triangle *near left*) to lay out the notches for the legs.

—Keith Hogan, Painesville, Ohio





Article updates

Issue 177 (July 2007)

■ In the review of trim routers on page 45, the bit opening on the Porter-Cable 310 subbase should be 1 3/16", as listed in the chart on page 46. Also, Grizzly does not offer optional bases for its model H7791 trim router.

Issue 178 (September 2007)

■ The MLCS Merle band clamp (part #9012, $27; 800-533-9298 or mlcswoodworking.com) featured on page 110 uses a 23" steel band rather than fabric.

Teen wins contest with first woodworking project

Your easy-to-follow plans helped a 16-year-old family friend, Jessica Kelly, build her first woodworking project. Jessica asked me to help her learn woodworking, and I was happy to oblige. After looking through my past issues of *WOOD®* magazine, she decided on the Arts & Crafts nightstand from issue 159 (November 2004). We shortened it 2" to match the height of her bed, built the top with a mitered frame, enclosed the back with a plywood panel, and chose a different style of drawer handle.

Jessica entered her nightstand in a regional woodworking competition through her school and beat out nearly 100 contenders to take first prize—the only girl ever to win. Now she says she's hooked on the hobby, and her next project will be the matching dresser in issue 160 (December/January 2004/2005).

—Dan Wassmuth, Cairo, Mo.

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2-Minute Router-Bit Tune-Up

It's tempting to just "grab and go" when chucking up a router bit. And why not? The bit worked fine the last time you used it.

The truth is that the effects of use (and sometimes abuse) accumulate, and the more you use a router bit, the less effective it becomes. Here are four essential steps to take before using a router bit:

1 Inspect for dirt, damage

Using a bright light—and a magnifier if necessary—thoroughly examine the bit. Look for dirt or deposits on the shank that might interfere with chucking up the bit, as well as gunk on the bit body and cutters. Examine the cutting edges carefully by shining the light right on the edge. A sharp edge will be nearly invisible, but dull or damaged carbide will reflect noticeably as you turn the bit in the light, as shown. This bullnose bit was dropped onto a concrete floor, damaging one cutting edge.

2 Clean from tip to shank

Give the bit a thorough cleaning to remove built-up dust, hardened pitch, and other deposits that may interfere with the cut. Remove the bearing, where necessary, and spray the bit with a good-quality bit cleaner. (See **Sources.**) Let it stand for a few minutes, and then wipe the softened deposits away with a clean cloth or paper towel. You might be surprised at how much gunk will come off even the cleanest-looking bits. Use a toothpick or soft brass brush to scrape debris from the recesses of the cutting edges and from the bearing, if the bit has one.

3 Lubricate the bearings

If the bit has a bearing, spin it with your fingers to be sure it turns freely. Bearings must turn freely to keep from burning workpiece edges. A drop of machine oil (or the lubricant that comes with the Bitsaver kit, sourced at *right*) will do the trick. Let it soak in for a second, and then spin the bearing several times to allow the lubricant to seep into the bearing and thoroughly coat internal parts. Wipe away any excess from the outside of the bearing, as well as any lube that may have gotten onto the bit body.

4 Hone the cutting edges

A fine or extra-fine handheld diamond hone works best, but be sure to hone only the flat face of the cutter, not the angled edge. A few swipes with the hone before each use is usually enough to keep bits at their best. If a bit will be used extensively, take it out of the router from time to time and hone it again. For badly dulled bits (or bits with damaged cutting edges), consider a professional sharpening or replacement.

Sources

Bit cleaners: Bitsaver kit, $20 (Empire Manufacturing, 866-700-5823, empiremfg.com); Blade & Bit, 8 oz., $10 (Boeshield, 800-962-1732, boeshield.com)

Diamond hones: "Credit Card" diamond sharpening cards, in three grits, $12 each (Woodcraft, 800-225-1153, woodcraft.com)

Shop Tips

Helping you work faster, smarter, and safer

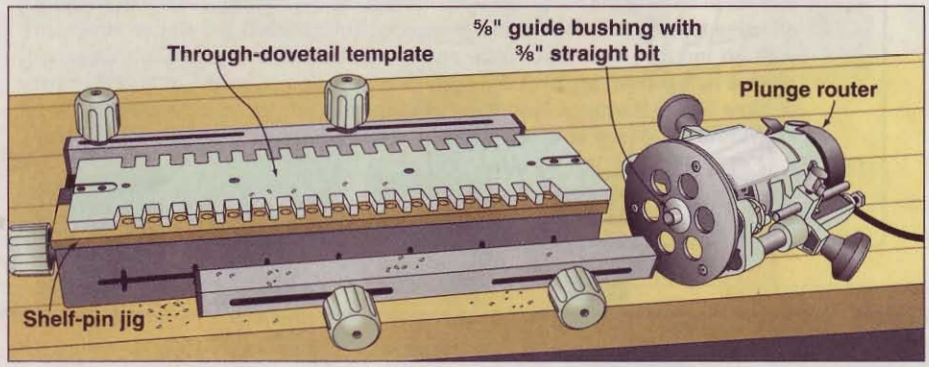
Simple and superior shelf pin templates

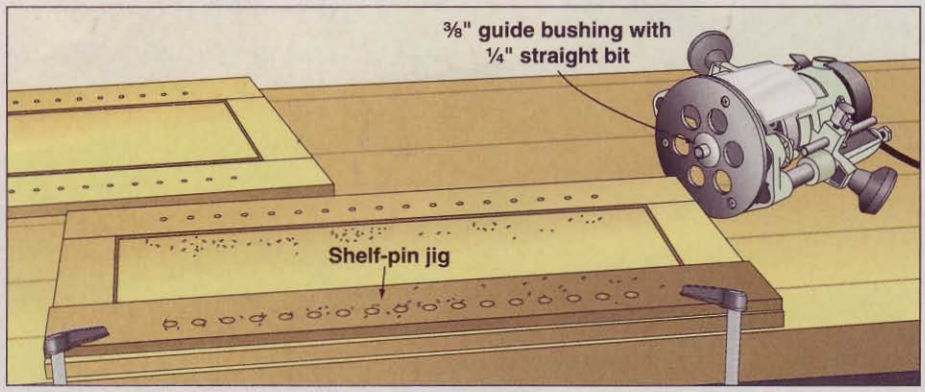
Top Shop Tip

Like most people, I've long used a simple perforated-hardboard template and a drill press to make shelf-pin holes. But the drill-press template was not completely accurate because the template holes tended to get bigger with each use. By abandoning the drill press in favor of a plunge router and the jig you see here, I am now able to use the same jig hundreds of times with no variation in the shelf-pin hole spacing.

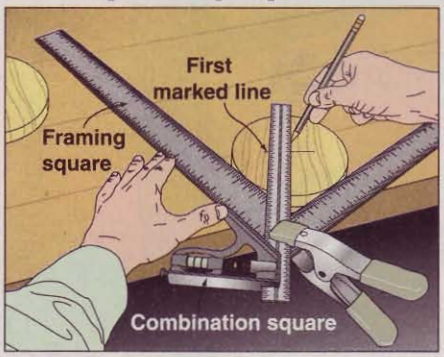
The basic idea is to use one jig, specifically a dovetail jig, to make another, the shelf-pin jig. Use the bits and bushings described in the illustrations both to build the jig and then use it. The dovetail template eliminates measuring and ensures perfect hole-spacing. In fact, the jigs are so easy and inexpensive to build that I made them in several lengths to accommodate various cabinet sizes.

—Jerry Collins, Georgetown, Texas





Two squares pinpoint the center of a circle



While trying to find the center of a circle, it occurred to me that pairing a combination square and a framing square should help do the trick. I clamped the squares together with a spring clamp as shown, and then marked a center line. Next, I rotated the disc about 90°—it's not critical—and marked another line that intersects with the first. That intersection is the center of the circle.

—Jim Skrocki, Painesville, Ohio

continued on page 18

The Top Tipster

Photo: C. Smith Photography

When we caught up with Jerry Collins, he was "between shops," making an intrastate move from Tomball to Georgetown, Texas. And, admittedly, he was getting antsy to get back to the business of crafting his wooden toys. "My favorites are the rocking toys," he says, such as the rocking Harley-Davidson motorcycle he built (shown at lower right in the photo *above*). As Jerry reassembles his shop, we look forward to seeing more Top Shop Tips like the one at *left*.

Consider it a shop-warming gift, Jerry: a DeWalt DW735 portable planer with our compliments for sending the Top Shop Tip.

Top tips earn tools!

Tell us how you've solved a workshop stumper, and you'll get $75 if we print it. And, if your tip garners Top Shop Tip honors, we'll reward you with a tool prize worth at least $250.

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Because we publish only original tips, please send your pointers only to *WOOD*® magazine. Sorry, submitted materials can't be returned.

5 Simple Ways to Trick Out Your TABLESAW

BROUGHT TO YOU BY DELTA®

No tool does it better. From cutting sheet goods to size, ripping planks to width, or sculpting precise joints, the tablesaw is your go-to machine for fast, accurate results. Of course, to tap its vast potential you must operate it safely and effectively and equip it with the proper accessories and jigs. In this article and related free jig plans, tips, and videos on the Web, you'll get the help you need for top results.

Watch two free videos demonstrating the three shop-made jigs shown in this article as well as tips on tuning up a tablesaw at woodmagazine.com/trickout.

TENONING JIG FOR CRISP CUTS

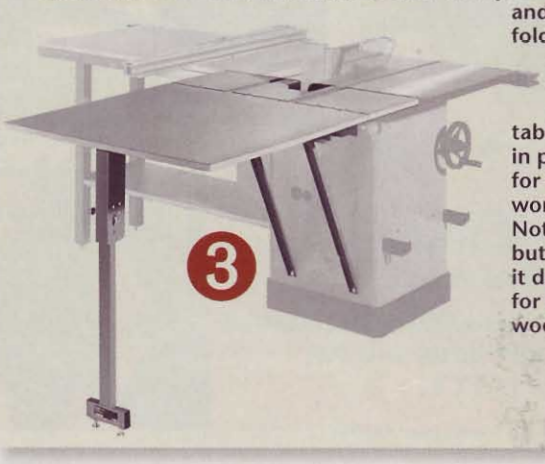
You don't need a high-priced dado set to cut clean, precise mortise tenons, stub tenons, and half-lap joints. A tenoning jig firmly supports your workpiece while you make the tricky cheek cuts with (ideally) a 40- or 50-tooth combination/general-purpose blade. Look for a model, such as the DELTA 34-184 *below,* with a T-slot guide bar that adjusts to fit your saw's miter slot for smoothly and precisely sliding the workpiece into a cut. A quick-release mechanism for switching between cheek cuts is another handy feature.

RIP THIN STRIPS EASILY

This basic jig gives you more than just ease-of-mind—it yields thin strips of precisely the same width all day long. To adjust it you simply tighten the knob on the sliding arm to lock in the approximate width of the strip, and then fine-tune the strip width by turning the brass screw. Find complete plans for building one at woodmagazine.com/trickout.

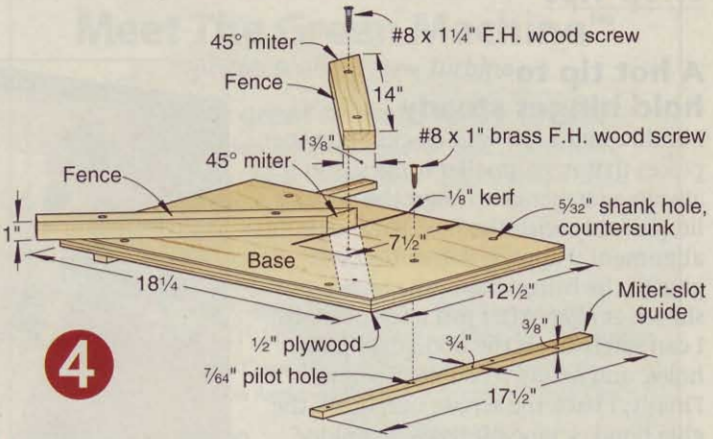
OUTFEED TABLE GIVES YOU SUPPORT

For cutting large workpieces, there's just no substitute for a generous outfeed table. It helps you make clean cuts by improving your leverage and keeping your focus on the cut, not worrying about losing control of the workpiece. The DELTA model 50-302, *below,* levels flush with your saw's top, and it quickly folds down when not needed. (A smaller table stays in place for shorter workpieces.) Nothing fancy, but boy, will it do wonders for your woodworking.



ON-THE-MONEY MITER JIG

Once you build this little beauty, you can rest assured that your miters will always match up. Use the process in the drawings *below right* to temporarily attach each fence with double-faced tape. Test the fences for accuracy by cutting four sample pieces, each about 1" wide and 4" long. Hold them together with a rubber band, and check for any gaps at the miters. Adjust the position of the fences as necessary. Then, permanently attach each fence to the base with two #8×1¼" screws. Finally, it's a good idea to attach adhesive-backed, 100-grit sandpaper to the fence faces. This will help prevent your workpieces from slipping during cuts.



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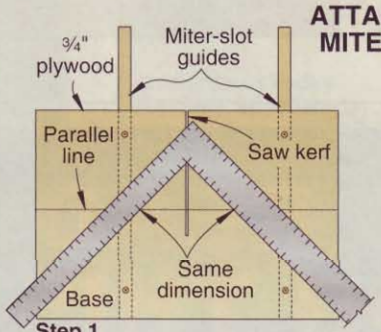
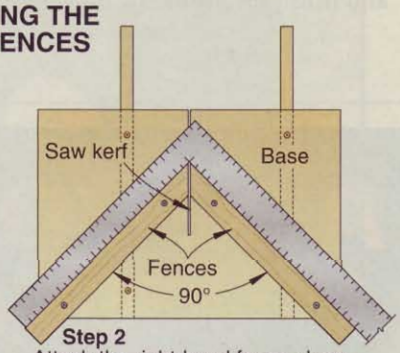
ATTACHING THE MITER FENCES



Step 1
Draw a line across the base parallel to its front edge. Center the inside corner of a framing square on the kerf and rotate it until the same dimension on both legs of the square intersects the parallel line.



Step 2
Attach the right-hand fence along one leg of the framing square and the left face against the other.

See more details on building these jigs at woodmagazine.com/trickout.

PANEL-CUTTING SLED

When you use this panel-cutting sled, you'll never wonder whether the corner you just cut is square. For hair-splitting accuracy, the beefy fence is fixed at 90° to the blade and shows exactly where your saw blade cuts. And, the fence-leading design holds wider workpieces more solidly and keeps your work closer than fence-trailing jigs.

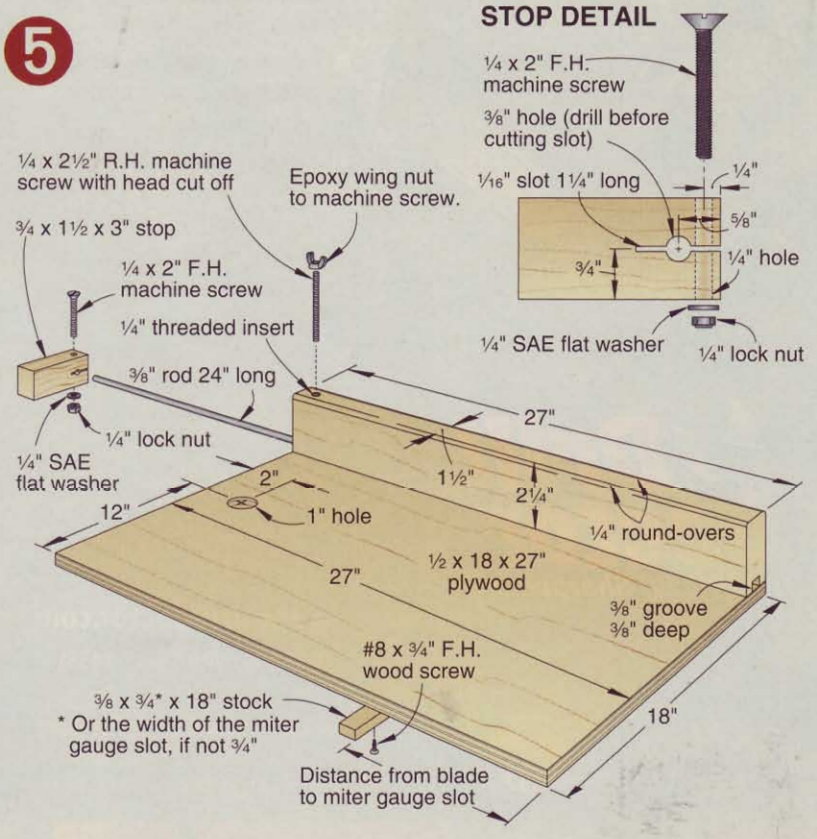
Build the jig according to the drawing at *right*. We made ours from birch-veneer plywood with a solid poplar fence, but you could use any ½" plywood or medium-density fiberboard and a straight scrap of 2×4. Cut both pieces ⅛" longer than shown; you'll trim them to their exact length after you build the jig.

Note: A well-tuned tablesaw is essential—its blade must be perfectly parallel to the miter slot to complete this project. See woodmagazine.com/trickout for information on tuning up your tablesaw.

With the sled's guide bar in your tablesaw's miter-gauge slot, crank the saw blade up to full height. Run the sled through the blade, slicing off the extra ⅛" from both the base and the fence.

You can now cut with confidence by aligning the cut line on your workpiece with the edge of the fence. For repetitive cuts less than 27", clamp a stop block to the fence. When cutting pieces up to 48", lock in the sled's built-in stop block.

5

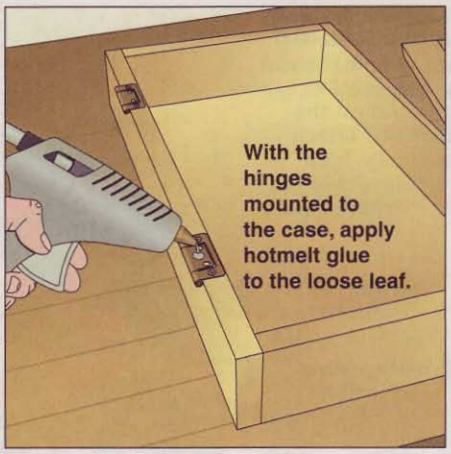

¼ x 2½" R.H. machine screw with head cut off
Epoxy wing nut to machine screw.
¾ x 1½ x 3" stop
¼ x 2" F.H. machine screw
¼" threaded insert
⅜" rod 24" long
¼" lock nut
¼" SAE flat washer
2"
12"
1" hole
27"
1½"
2¼"
¼" round-overs
½ x 18 x 27" plywood
⅜" groove ⅜" deep
#8 x ¾" F.H. wood screw
⅜ x ¾* x 18" stock
* Or the width of the miter gauge slot, if not ¾"
18"
Distance from blade to miter gauge slot

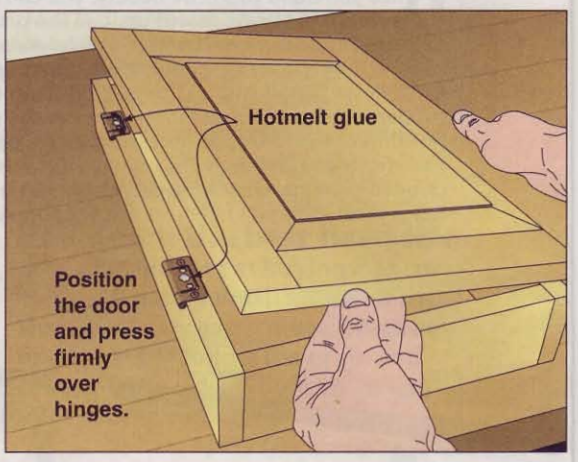
STOP DETAIL

A hot tip to hold hinges steady

I build quite a few wall clocks and other pieces that need smaller hinges, and it's always a challenge to align the door or lid perfectly with the box. For foolproof alignment, I apply a dab of hotmelt glue to the hinges using the technique shown at *right*. After just a few seconds, I can safely open the door, drill pilot holes, and install a couple of screws. Finally, I back the screws out, break the glue bond, scrape off the glue residue, and finish installing the hinges.

—Ronald Miller, McPherson, Kan.





ARE YOU READY FOR THIS?

Check all that apply:

- I have a collection of old dull drill bits I just can't throw away.
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- I know I should sharpen my drill bits, but I don't have time to become a sharpening expert.
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Circle No. 1511

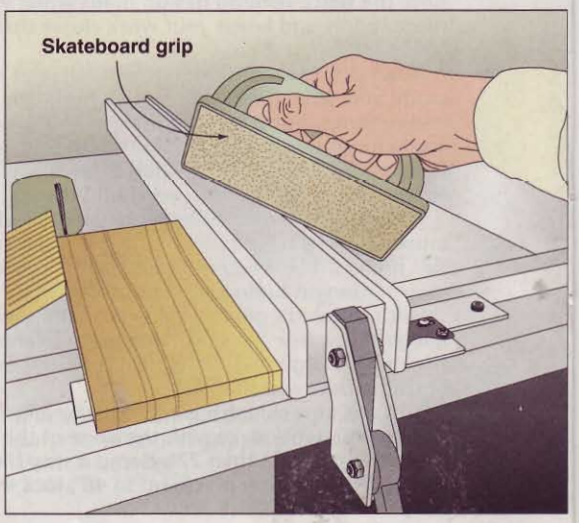
Get a totally gnarly grip on your boards

Through my many years of reading *WOOD®* magazine, I'm still amazed at the uncommon ideas used to solve common problems in the shop. I recently had one when I helped my son overhaul his skateboard.

Skateboard grip—the stuff 'boarders put on top to make a non-slip surface—has an extremely strong self-adhesive backing with a grit-textured surface. I started using the grip on my push blocks, mitersaw fences, and other jigs and tools where I don't want wood to creep during machining. It's totally awesome!

The grip comes in sheets or rolls and a variety of styles. You can even use bright colors to make your shop a little more "rad." You'll find it at any decent skateboard shop and some sporting-goods stores.

—Robert Galbraith, Oshawa, Ont.



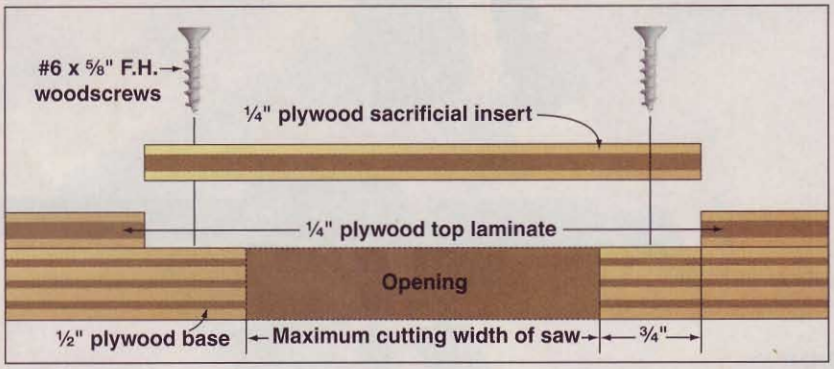
Sacrificial insert saves sled's integrity

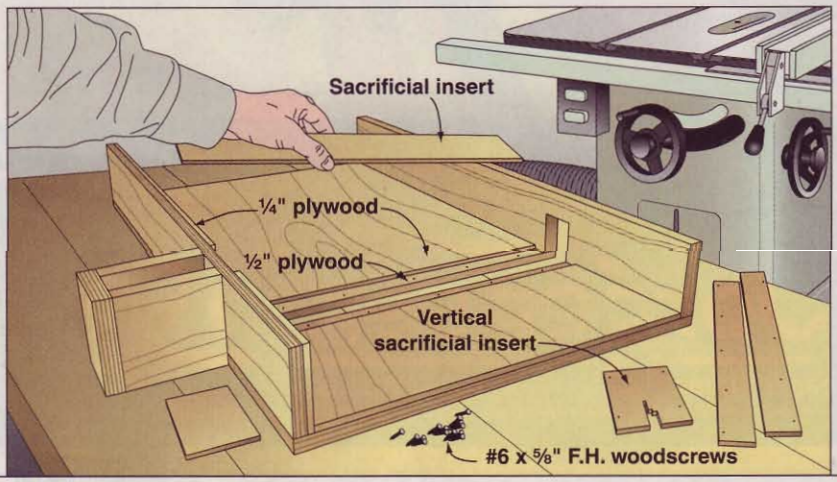
My tablesaw crosscut sled has been one of the most useful tools in my workshop. However, I've also found that, unless I use the same blade each time, the kerf widens and I can't rely on it anymore for chip-free cuts. And I can't make bevels or dado cuts without trashing the sled. My solution: sacrificial inserts over both cutting areas of the saw.

To apply this idea in your shop, first determine the maximum cutting width of the saw from a 45° bevel cut to a full dado stack at 0° bevel. Then, set back the ¼"-plywood sled bed ¾" from each side to create a shoulder for the insert. Use the same technique to size and locate the vertical sacrificial insert for the rear fence. Attach the inserts with wood screws, keeping the screw heads below the surface of the insert so they won't accidentally scratch a workpiece.

You can now install different inserts for each blade, bevel angle, or dado size. When either insert no longer provides the needed zero-clearance, simply replace it.

—Don Mullikin, St. Petersburg, Fla.

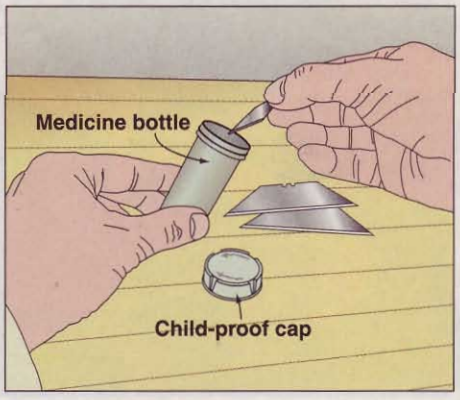




Safe storage for sharp garbage

Every once in awhile, I throw away something by mistake and have to do a little digging in the trash to retrieve it. I get skittish, though, because I never know if I'm going to plunge my hand onto something sharp. To prevent this potential hazard, I keep a small medicine bottle on my workbench in which I accumulate used utility knife blades, razor blades, and other sharp waste products. When the bottle is filled, I cap it and discard it.

—Stanley Krasovic, Honesdale, Pa.



continued on page 20

Sawdust. It invades your workshop, threatening to take over. But with **CleanStream Pro Filters** on your side, sawdust doesn't stand a chance. CleanStream adds true HEPA filtration to your wet/dry vac. So no matter what kind of dust you're sucking up, 99.97% of even the finest particles, down to 0.3 microns, are kept out of the air. CleanStream won't clog, and it lasts longer than any other filter out there. We even have a one-year guarantee to prove it. Declare victory over sawdust today. With CleanStream. ***www.cleanstream.com***

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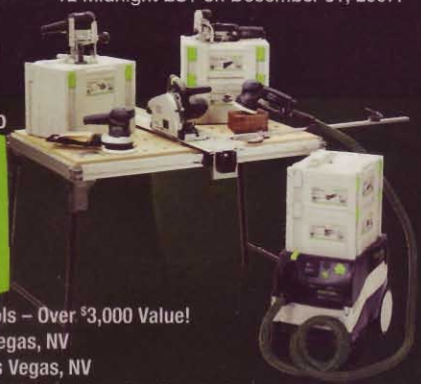

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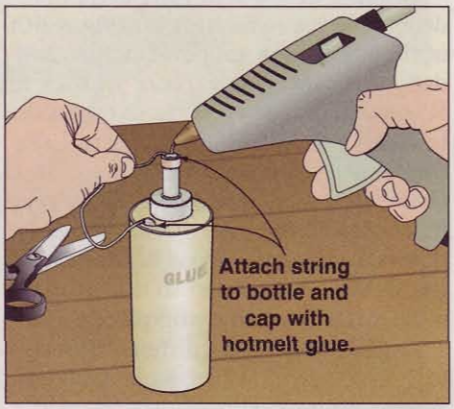
Circle No. 700

Shop Tips

A leash for the glue-bottle cap

All of us have experienced the problem of the elusive glue-bottle cap. As we work on a project, the cap gets harder and harder to put back on the bottle, so we eventually leave it off. Then it immediately disappears. To solve this problem, I attached the cap to the bottle using a 6" length of string.

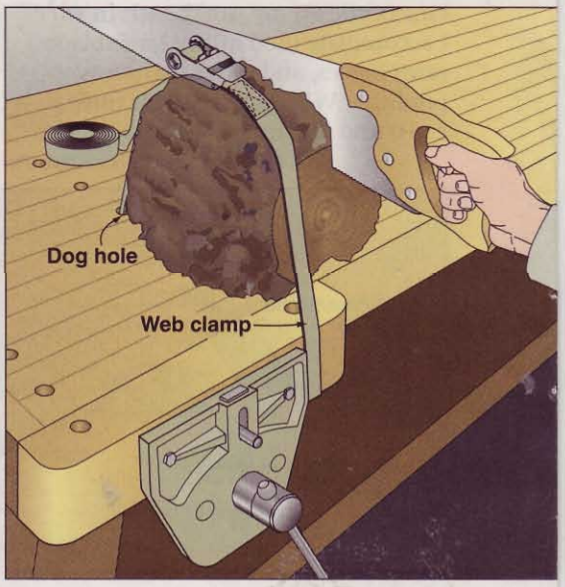
—Ron Altier, West Lafayette, Ohio



Odd-shaped piece? Strap that rascal down

Not everything a woodworker has to deal with has straight sides or square corners to help secure it. Sometimes, as in the case of burl, it can be as hard to hold onto as a greased pig. To clamp large, irregular-shaped material to a workbench, use a web clamp fed through a dog hole, under the bench, and over the object.

—James Morin, West Hartford, Conn.



continued on page 22

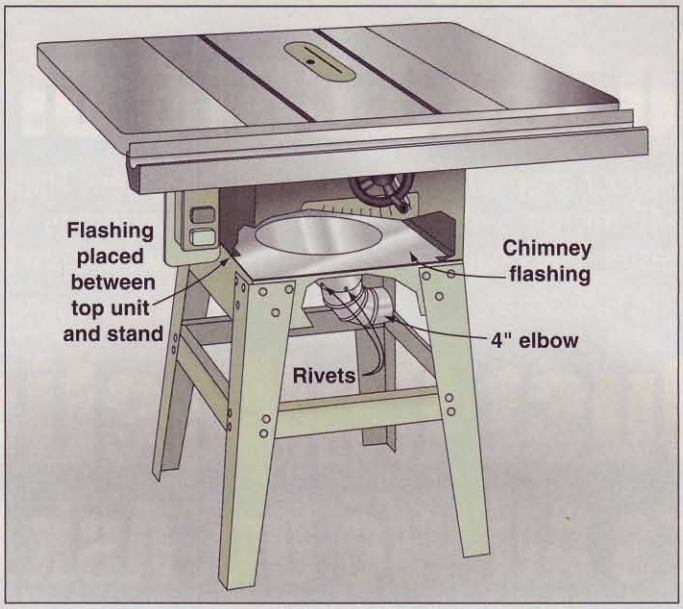
Make contractor-saw dust disappear in a flash(ing)

Capturing dust from my contractor-style tablesaw has always been impossible because of the wide-open bottom. But recently, I spotted an all-metal chimney flashing at a home center and immediately recognized I had my solution.

The flashing has a 16×18" base large enough to sandwich firmly between the saw's leg stand and the top unit to basically seal the housing. To create a coupling for my dust-collection system, I widened the tapered 3½" opening to 4", inserted a 4" metal elbow, caulked the connection to seal it, and fastened the two together with pop rivets.

The small openings around the blade adjustments provide a little replacement air for better airflow, and I now catch 98 percent of the dust that was getting away before.

—Erin Bennett, Toledo, Ohio



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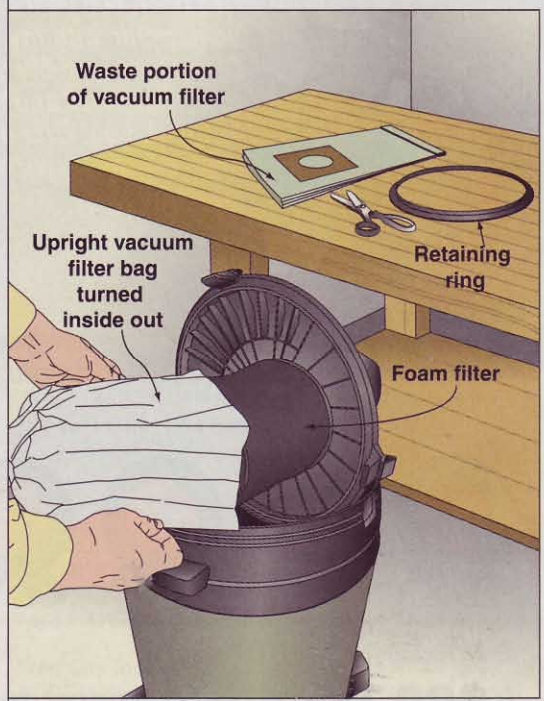
Circle No. 2058

Frugal filters for fine dust collection

The microfiltering bags and filters made especially for catching fine dust in shop vacuums can get expensive after replacing a few. But the ones sold for standard upright vacs are much more economical. I buy the cheap ones; then modify them to fit my shop vacuum.

To retrofit the bag, I first cut the top off just past the point that includes the small opening. Next, I turn the bag inside out so the air will still flow through the filter in the normal direction, slip it over the foam filter of my shop vacuum, and use the standard retaining ring to hold it in place.

—Barry Terrell, Houston, Texas



Wise Buys

Our Experts Test

No-Hose Brad Nailers

Why buy?

Eighteen-gauge brads can make project assembly a clamp-free task, and they also work great for installing trim and molding in homes. With brads, you get the length—2⅛" is the maximum—of a 15- or 16-gauge finish nail, but with a smaller hole to fill. Gas- or battery-powered brad nailers handle these jobs just as well as their pneumatic cousins, but without the fuss of dragging around an air compressor and hose. They also make the perfect tool for a trim carpenter returning to a job site for punch-list work.

PASLODE IM200F18, $270

Weight: 4.9 lbs.
Brad capacity: ⅝" to 2"

Editor test-drive:

I never realized how restricted I was until I used Paslode's gas-powered brad nailer. Before, I was tethered to my air compressor and hose, but no longer! The IM200F18 drives brads—and sinks them—into any hardwood or sheet goods. Before trusting it to install trim in my house, I drove several sizes of brads into ¾" hard maple, plywood subflooring, and even 2" red oak. It never failed to sink even one brad. With that confidence, I used it to install fir baseboard, shoe molding, and door and window trim in my home, and it performed flawlessly.

The IM200F18 requires a 6-volt rechargeable battery as well as gas-filled fuel cells (replacement cells cost $5 each). Together they spark a small explosion to drive a piston, like the engine in your car. I drove more than 1,200 nails before exhausting the first cell—without draining the battery. The nailer has an adjustable depth setting that proved easy to use, and the rubber bumper on the nose prevented dents in the wood.

—Tested by Kevin Boyle, Senior Design Editor

To learn more:

800-682-3428; paslode-cordless.com

SENCO FINISH 25, $350

Weight: 6.3 lbs.
Brad capacity: ⅝" to 2⅛"

Editor test-drive:

It's heavy and feels awkward at first, but after using the 14.4-volt rechargeable Senco Finish 25 on a few jobs I knew it would become a permanent addition to my shop. As a cabinetmaker who also makes custom molding, I'm working on job sites as much as in my shop, so I appreciate the freedom the Finish 25 affords me. It's a real timesaver to not have to lug around an air compressor and hose—and I don't have to worry about scratching a client's hardwood floors, cabinets, or countertops.

The Finish 25 has ample power for driving brads in hardwoods as well as pine and plywood. Although it has multiple depth settings, I left it on the deepest setting most of the time and was pleased with the results. It has excellent tip visibility for brad placement, and it never left an indentation on the wood. I also like that it will not fire when the magazine empties, protecting the driver. Still, I wish the nailer was smaller to reach into tight spaces, and that it would stand on its battery. It comes with two batteries and a one-hour charger.

—Tested by Ben Svec, Contributing Craftsman

To learn more:

800-543-4596; senco.com

It's not exactly hoseless, but you don't need a compressor

KOBALT COMPRESSED-AIR REGULATOR MODEL #J-6901-100, $100

Editor test-drive:

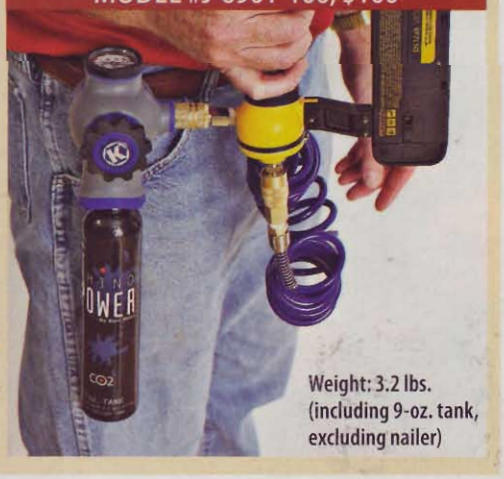
I have to admit it: I was intrigued by Kobalt's J-6901-100 compressed-air regulator because it looks cool, but at the same time I was skeptical of its abilities. Here's how it works: A tank filled with compressed carbon dioxide (CO_2) provides the power for your pneumatic brad nailer (not included). You control the CO_2 pressure with the regulator, which clips onto your belt.

It didn't take long to dial in the regulator, but it worked best at the maximum of 120 psi; lower levels just didn't sink longer nails. Using my own nailers, I drove 2", 18-gauge brads into red oak and hard maple, and it socked them in perfectly. I noticed that some nailers require more air per nail than others (based on watching the draw on the pressure gauge), so you might have to wait a second or two between nails. I also tried the Kobalt with my 15-gauge finish nailer, and it powered that driver with no problem. I drove a combined 268 brads and finish nails of assorted lengths on a 9-oz. tank. When you've expended your tank's supply, return it to Lowe's for an exchange. Replacements cost $16 for the standard 9-oz. tank, and $27 for the optional 20-oz. tank ($36 new).

—Tested by Bob Hunter, Tools and Techniques Editor

To learn more:

800-445-6937; lowes.com



Weight: 3.2 lbs. (including 9-oz. tank, excluding nailer)

Quick and Easy Jig

Drum-sanding guide

Sand perfect round-end cutouts on your drill press or spindle sander.

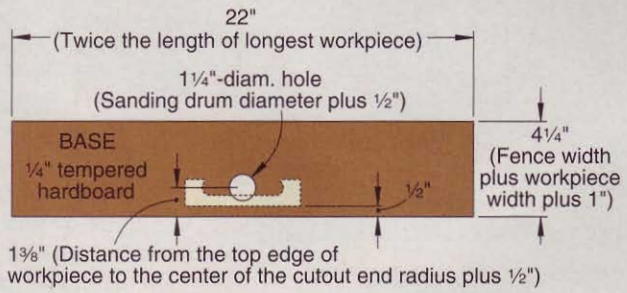
When forming cutouts like the ones in the base sides and ends (C, D) of the ikebana vase project on *page 68*, the cutout edges must be sanded, even after careful bandsawing. You'll want to keep the straight middle straight, the round ends round, and the transition between the two smooth. To get consistent results, here's a simple guide you can make in a hurry. The one shown fits the ¾" sanding drum used on the ikebana vase project, but you can make one to fit any size sanding drum, and use it on your drill press or spindle sander.

Cut a ¾"-thick scrapwood fence and a ¼" tempered-hardboard base to size. Make the fence 1" wider than the diameter of the sanding drum and the base 1" wider than the workpiece width plus the fence width. Make both parts twice the length of the longest part you need to sand. Then mark a hole center on the base [**Step 1**], and bore a hole ½" larger in diameter than the diameter of the sanding drum. Now position the fence on the base [**Step 2**], and trace the portion of the hole that the fence overlaps onto the bottom of the fence. Bandsaw along the traced line. Adhere the fence to the base with double-faced tape.

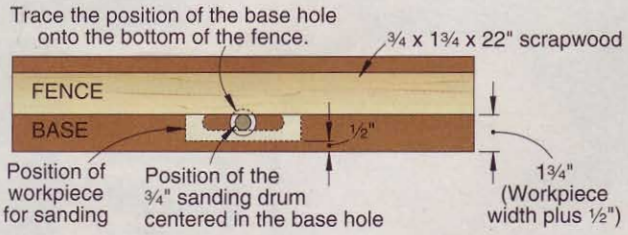
Place the fence on the drill-press table, lower the sanding drum into the hole, and lock the quill. On a spindle sander, simply place the fence over the sanding drum. Position the fence [**Step 3**], and clamp it in place. Now, after bandsawing the cutout close to the pattern line, sand it to final shape by moving the part back and forth over the drum until both "feet" contact the fence, the cutout ends are perfectly round, and the sanding drum quits removing material from the center.

Illustrations: **Roxanne LeMoine; Lorna Johnson**

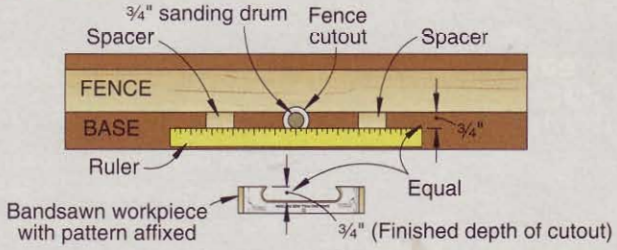
STEP 1 LAY OUT THE SANDING DRUM HOLE ON THE BASE


22"
(Twice the length of longest workpiece)
1¼"-diam. hole
(Sanding drum diameter plus ½")
BASE
¼" tempered hardboard
½"
4¼"
(Fence width plus workpiece width plus 1")
1⅜" (Distance from the top edge of workpiece to the center of the cutout end radius plus ½")

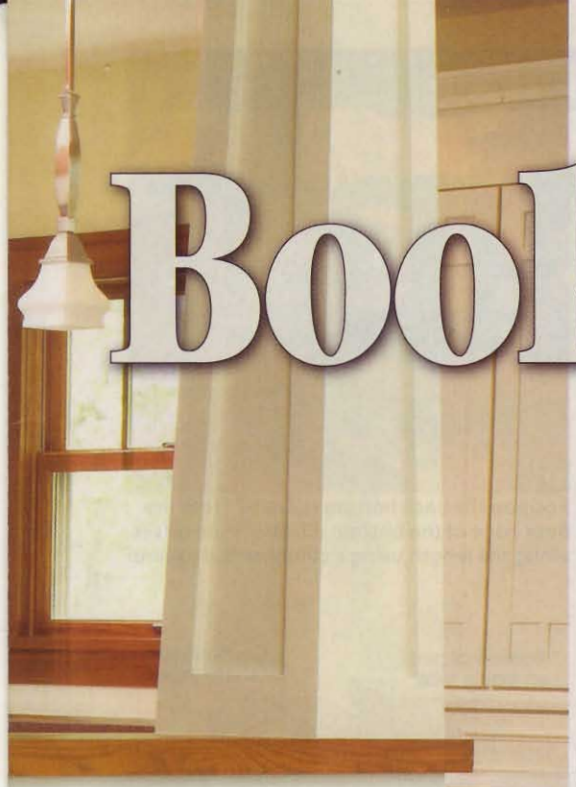
STEP 2 MARK THE FENCE


Trace the position of the base hole onto the bottom of the fence.
¾ x 1¾ x 22" scrapwood
FENCE
BASE
½"
Position of workpiece for sanding
Position of the ¾" sanding drum centered in the base hole
1¾"
(Workpiece width plus ½")

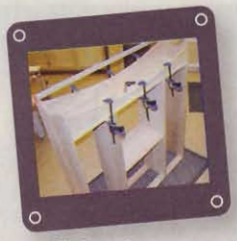
STEP 3 POSITION THE FENCE



Mission



Bookcase



See a Slide Show of this project coming together at woodmagazine.com/slides

Showcase your craftsmanship with this easy-to-build masterpiece. It goes together using straightforward rabbet, dado, and groove joinery. Super-simple faux tenons give the look of through-tenons for the bottom rails.

PROJECT HIGHLIGHTS

- Overall dimensions: 57" wide × 13" deep × 55" high.
- Materials needed: Quartersawn white oak and ¼" quartersawn white oak plywood.
- For a convenient way to get all of the hardware needed for the doors plus brass paddle supports for the shelves, see **Source**.

Skill Builder

- Learn how to easily make faux tenons that fit inside shallow mortises, making the tenons virtually indistinguishable from "the real deal."

Start with the case

1 From edge-joined white oak (we used quartersawn), cut the sides (A), dividers (B), fixed center shelf (C), adjustable center shelves (D), adjustable side shelves (E), bottom (F), and top (G) to the sizes listed [**Materials List**, *page 34*]. Mark the time of glue-up on the boards, as explained in the **Shop Tip**, *below*. Then cut the cleats (H) and bottom rails (I) to size.

2 Using a dado blade in your tablesaw, cut the ¾" dadoes ⅜" deep into the appropriate faces of the sides (A), dividers (B), bottom (F), and cleats (H), where dimensioned [**Drawings 1** and **2**, **Photo A**]. To safely guide the long parts, attach an extension to your miter gauge. Next, using an auxiliary fence attached to your rip fence, cut the ¾" rabbet ⅜" deep along the *top* end of each side on the *inside* face. Now cut the ¼" rabbet ⅜" deep along the *back* edge of each side to receive the plywood back (L).

3 Using a compass, draw the 4" radius at the bottom of each side (A), where dimensioned [**Drawing 1**]. Jigsaw or bandsaw (with a support stand) to shape, and sand smooth. Next, mark the center of the arch on a bottom rail (I), where dimensioned. Draw the arch using a fairing stick. (For a free fairing stick plan, go to woodmagazine.com/fairing.) Bandsaw and drum-sand the arch to shape. Using this rail as a template, draw the arch on the other rail. Bandsaw and sand it to shape.

4 Rout ⅛" round-overs along the bottom *ends* of the sides (A) [**Drawing 2**]. Complete the round-overs on the bottom *edges* using a 150-grit sanding block.

5 Mark centerpoints for holes to receive the ¼" brass paddle supports for shelves on the appropriate faces of the sides (A) and dividers (B) [**Drawings 1** and **2**]. Note that the holes in the sides

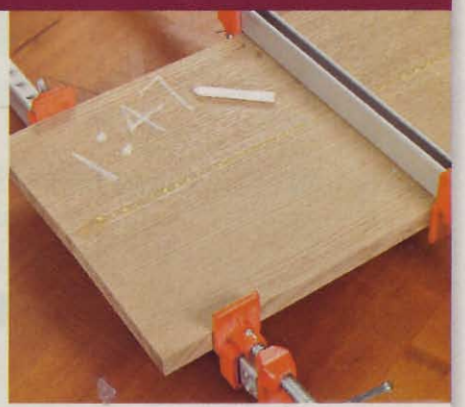
CUT THE DADOES IN THE CASE PARTS

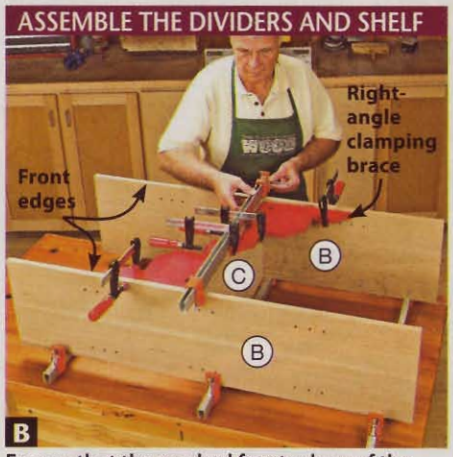
Use your tablesaw fence as a stopblock to ensure identical dado locations in the sides (A), dividers (B), bottom (F), and cleats (H).

SHOP TIP

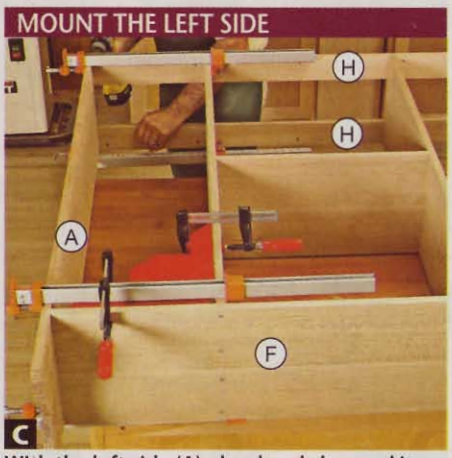
A simple way to track glue-up times

When you have a limited number of clamps and several glue-ups to do, you don't want to leave the parts in the clamps longer than needed. On the other hand, you don't want to remove the parts before the glue has firmly set, risking misaligned or poorly joined workpieces. (Yellow glue sets in approximately 30 minutes at a temperature above 50° F.) Here's a simple method to keep things straight. Mark the starting time of each glue-up with chalk. That way, you'll know when you can safely remove the boards from the clamps, and you can tell which boards were glued up the longest so you can work on them first.

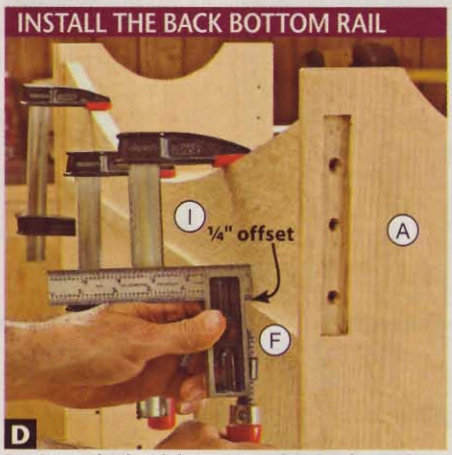




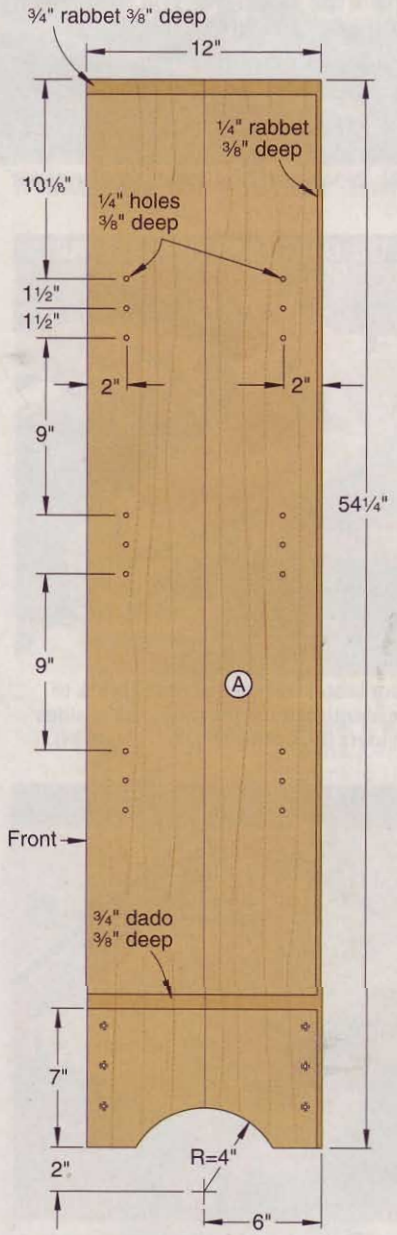
Ensure that the marked front edges of the dividers (B) face up. Then glue and clamp the dividers and fixed center shelf (C) together.



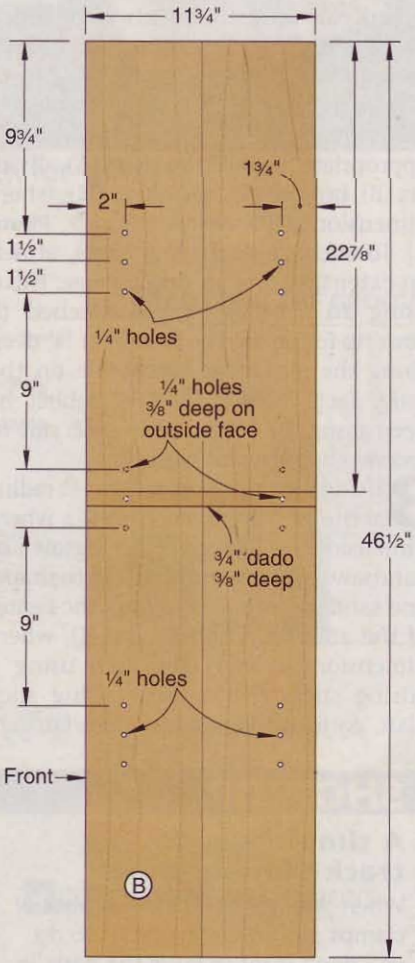
With the left side (A) glued and clamped in place, drill angled countersunk mounting holes through the cleats (H) and into the side.



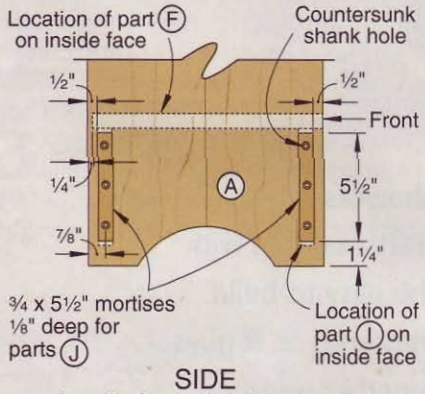
Position the back bottom rail (I) ¼" from the *back* edge of the bottom (F). Check the offset along the length using a combination square.



LEFT SIDE
(inside face shown, right side is a mirror image)

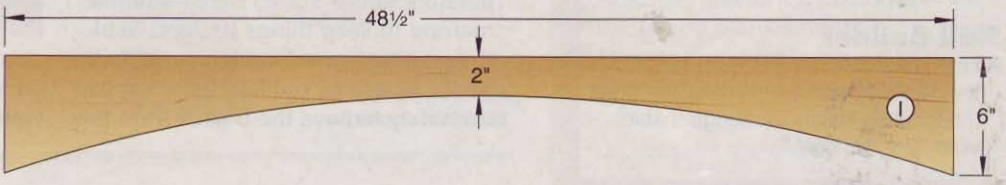


LEFT DIVIDER
(inside face shown, right divider is a mirror image)



SIDE
(outside face of left side shown)

1 PARTS VIEW



and the center group of holes in the *outside* faces of the dividers are ⅜" deep. The top and bottom groups of holes in the dividers are through-holes. Drill the holes using a brad-point bit and a backer to prevent tear-out of the through-holes. Use a fence with a stopblock on your drill press to ensure alignment and consistent spacing of the holes, and wrap a piece of masking tape around the bit for a visual depth stop when drilling the ⅜"-deep holes. To ensure correct orientation of the dividers during assembly, identify the front edges.

6 On the *bottom* face of the bottom (F) and *top* faces of the cleats (H), mark centerpoints for mounting holes centered over the dadoes for attaching the parts to the dividers (B) [**Drawing 2**]. Then mark centerpoints for mounting holes on the *bottom* face of the *front* cleat and for 3⁄16" slots 9⁄16" long on the *top* face of the *back* cleat [**Drawing 2a**] for attach-

ing the top (G) later. To ensure correct orientation of the back cleat during assembly, identify the back edge. Drill the countersunk shank holes, and form the slots. For the #8 screws in this project, drill 5/32" shank holes and 7/64" pilot holes. You'll drill the angled countersunk shank holes at the ends of the cleats and into the sides (A) when mounting the cleats to the case.

7 Lay out the ¾×5½" mortises at the bottom of the sides (A) on the *outside* faces [**Drawing 1**] to receive the faux tenons (J) [**Drawing 2**]. Rout the ⅛"-deep mortises, and square the corners with a chisel. To easily and precisely rout the mortises using a template and a pattern bit, see *page 84*. Then drill the countersunk shank holes through the mortises for attaching the bottom rails (I).

8 Sand all of the parts to 220 grit. Set the adjustable center and side shelves (D, E) and top (G) aside.

Assemble the case

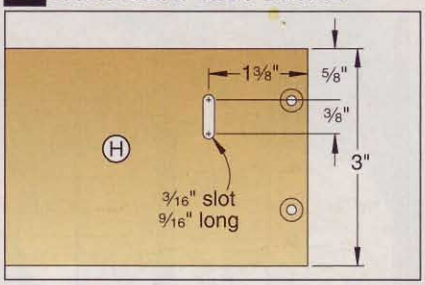
1 Glue and clamp together the dividers (B) and fixed center shelf (C) [**Drawing 2**, **Photo B**]. Use right-angle clamping braces to keep the assembly square. (For a free clamping brace plan, go to woodmagazine.com/brace.)

2 Glue the bottom (F) to the dividers/shelf assembly (B/C). Using the shank holes in the bottom as guides, drill pilot holes into the dividers. Drive the screws. In the same way, glue and screw the cleats (H) to the dividers, aligning the cleats flush with the front and back edges of the dividers and ensuring the cleat with the slots is correctly oriented at the back.

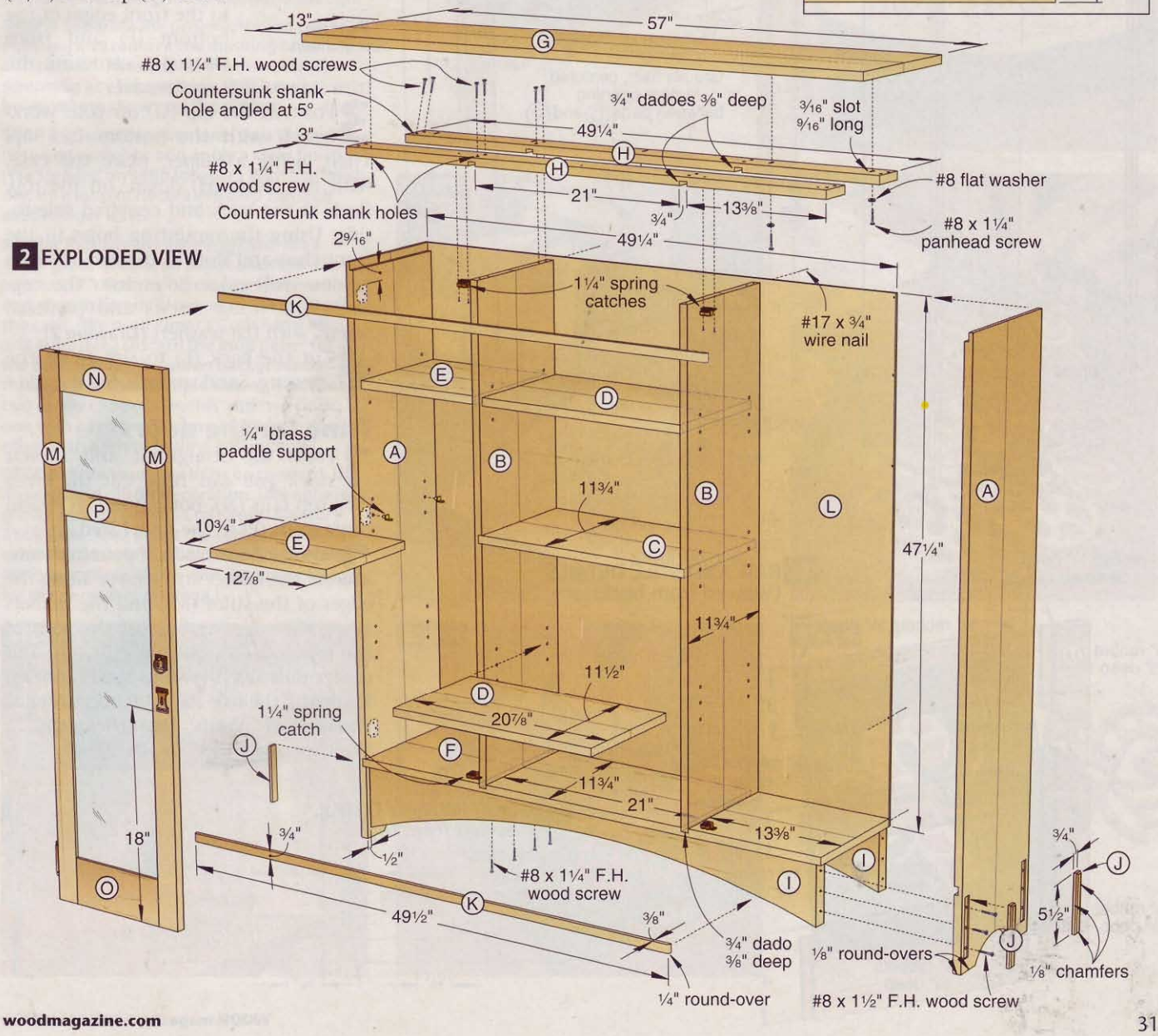
3 Glue and clamp the left side (A) to the bottom (F) and cleats (H), flush at the front. Then drill countersunk mounting holes, angled at 5°, through the cleats and into the side [**Drawing 2**, **Photo C**]. Drive the screws. Now mount the right side to the assembly.

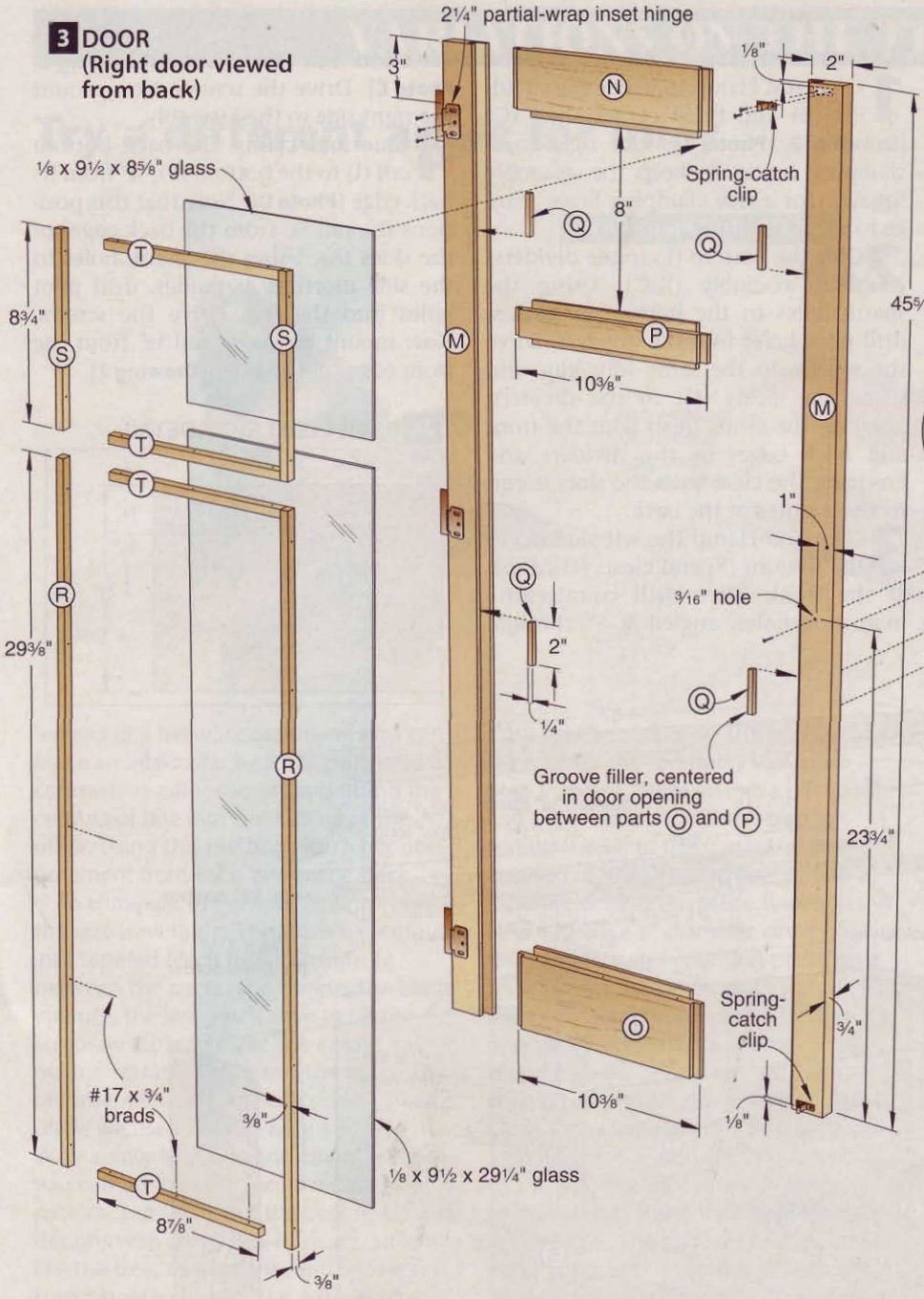
4 Glue and clamp the back bottom rail (I) to the bottom (F), ¼" from its back edge [**Photo D**]. Note that this positions the rail ½" from the back edges of the sides (A). Using the shank holes in the side mortises as guides, drill pilot holes into the rail. Drive the screws. Now mount the front rail ½" from the front edges of the sides [**Drawing 2**].

2a BACK CLEAT SLOT DETAIL



2 EXPLODED VIEW





Add the trimmings

1 To form the faux tenons (J) to fit into the mortises in the sides (A), cut a 5½×12" piece from ¾" stock. (We test-fitted the stock to ensure a snug fit in the ¾×5½" mortises.) Rout ⅛" chamfers on each end [**Drawing 2**]. Sand the ends smooth. Then crosscut a ⅜"-long tenon from each end. Repeat to make two more tenons. For help with this process, see *page 84*. Now glue the tenons into the side mortises.

2 Cut the trim (K) to the size listed. Rout a ¼" round-over across both ends of each trim piece [**Drawing 2**], backing up the pieces with scrap to prevent tear-out. Sand smooth. Then, glue and clamp the trim to the front edges of the bottom (F) and front cleat (H), centering the trim side-to-side on the case.

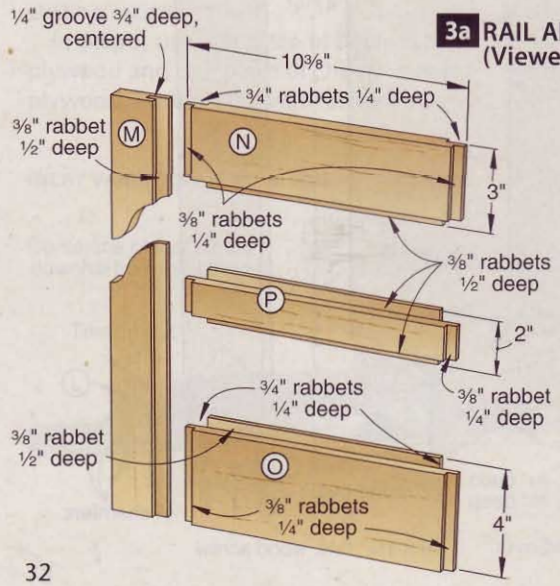
3 Position the top (G) on your workbench with the bottom face up. Then, using a helper, place the case, with the cleats (H) down, on the top, flush at the back and centered side-to-side. Using the mounting holes in the front cleat and slots in the back cleat as guides, drill pilot holes into the top. Drive the wood screws and panhead screws with flat washers [**Drawing 2**].

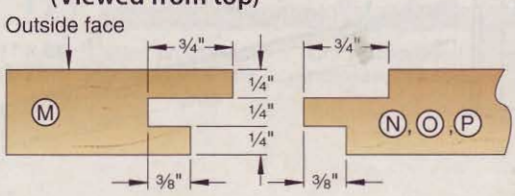
4 Cut the back (L) to size to fit the opening. Sand smooth. Set it aside.

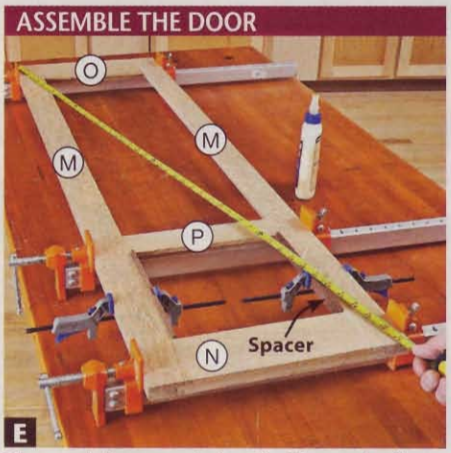
Time for the doors

1 From the straightest and flattest stock you can find, cut the stiles (M), top rails (N), bottom rails (O), and center rails (P) to the sizes listed.

2 Using a dado blade in your tablesaw, cut the rabbet and groove along the edges of the stiles (M), and the rabbets along the edges and across the ends of the top rails (N), bottom rails (O), and center rails (P) [**Drawings 3**, **3a**, and **3b**] following the five-step cutting sequence [**Drawing 4**]. Verify that the parts fit together correctly.

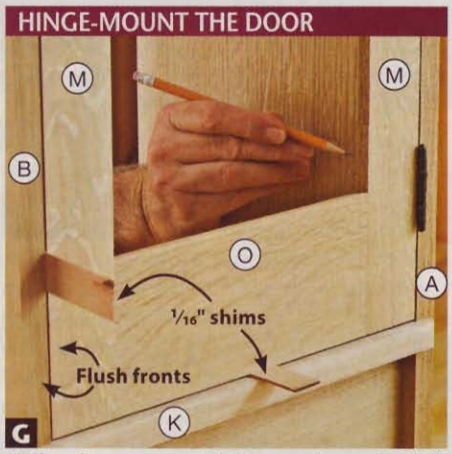






Glue and clamp each door's stiles and rails together, positioning the center rail (P) with 8"-long spacers. Check the door for square.

Use a spacer to position the top and bottom door hinges on the sides (A) 2 9/16" from the bottom (F) and front cleat (H).



With a door centered in its opening using 1/16" shims, and flush at the front, mark the hinge mounting holes on the stiles (M).

3 To assemble the doors, cut two 1×8" spacers from ¼" hardboard for positioning the center rails (P). Then, glue, assemble, and clamp the stiles and rails for a door together with the spacers [**Photo E**]. Repeat for the other door.

4 Cut the groove fillers (Q) to size. Glue and clamp the fillers into the grooves in the stiles (M), centering the fillers in the top and bottom door openings [**Drawing 3**]. The fillers keep the glass centered side-to-side in the doors.

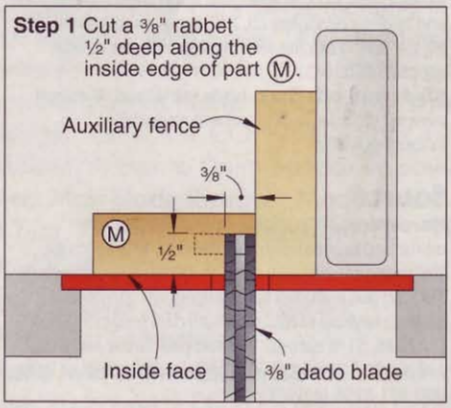
5 Cut the bottom vertical glass stops (R), top vertical glass stops (S), and horizontal glass stops (T) to the sizes listed to fit the rabbeted openings in the doors. To prevent splitting of the stops during installation, drill pilot holes through the stops using a #17×1" brad with its head snipped off.

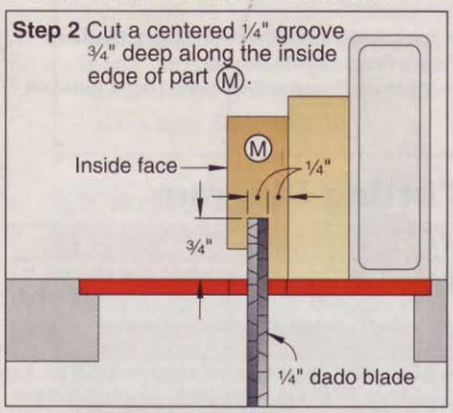
6 Have pieces of ⅛" glass cut to fit the door openings less ⅛" in width and length. For an aged look, we used a "seedy"-style glass, which we found at our local glass store. This type of glass has air-bubble inclusions and some texturing. If you choose to use this type of glass, make sure that you specify the widths and lengths (not just the dimensions) for the glass so that the texturing runs in the same direction. You'll install the glass and stops after finishing.

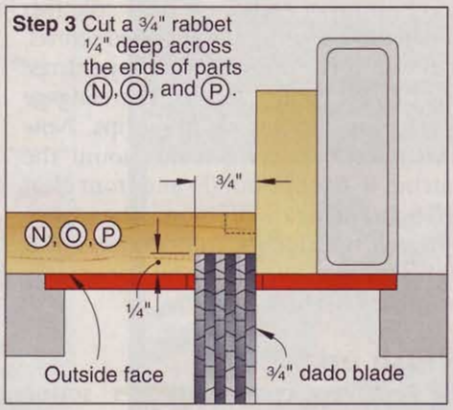
7 To mount the doors, cut a 2 9/16×3" spacer from ¼" hardboard. Using the spacer to position the 2¼" partial-wrap inset hinges at the top and bottom of each side (A) [**Drawing 2**, **Photo F**] and keeping the hinge barrels tight against the front edges of the sides, mark the mounting holes centered in the hinge openings. Drill pilot holes, and fasten the hinges to the sides using the supplied screws. Then mount the remaining hinges centered along the door opening on each side.

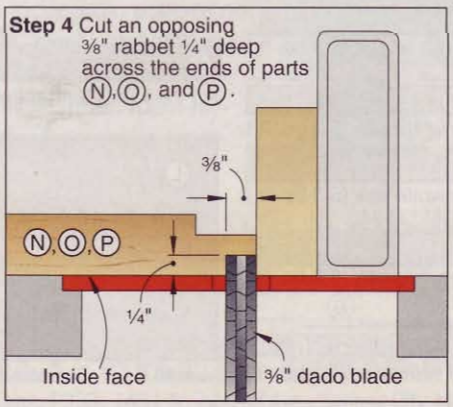
8 Center each door in its opening by inserting 1/16" shims at the top, bottom, and side of the door opposite the

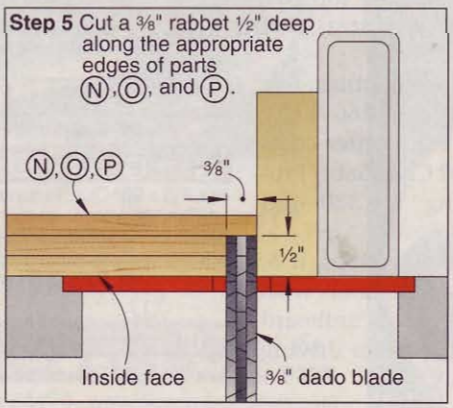
4 CUTTING THE TENONS AND GROOVES INTO THE DOOR STILES AND RAILS











SHOP TIP

Keep screws on the tip of a screwdriver with this trick

How many times have you tried to guide a screw on the end of your screwdriver into a mounting hole and had the screw fall off (and, as Murphy's Law would have it, roll out of sight)? Here's a simple way to avoid the frustration (and hunt). Transform your ordinary screwdriver into an "attractive" one by attaching a rare-earth magnet to it near the tip. A magnet as small as ¼" in diameter provides plenty of pull to hold a screw securely to the tip, making positioning and driving the screw in any orientation or tight space a snap.

hinges. (The hinges offset the door 1/16", so you don't need shims on this side.) Ensure that the doors are flush at the front. Then, reach through the back of the case and mark the hinge mounting holes on the door stiles (M) [**Photo G**]. Remove the doors. Drill the pilot holes.

9 Mark a centerpoint on each *inner* door stile (M) for the 3/16" hole to receive the threaded boss on a 1⅛" ring pull [**Drawing 3**]. (The pull mounts with a screw at the top and an escutcheon pin at the bottom.) Drill the holes, using a backer to prevent tear-out. You'll mount the pulls and keyhole escutcheons after finishing.

10 Mount the clips for the 1¼" spring catches ⅛" from the top and bottom of each *inner* door stile (M) and centered, using the supplied screws. Reposition the doors in their openings, and drive the hinge screws. Then engage the spring catches on the clips. Now drill pilot holes, and screw-mount the catches to the bottom (F) and front cleat (H) [**Drawing 2**]. Because the space between the catches and dividers (B) is tight, see the **Shop Tip**, *above*, for an easy way to drive the screws.

Finish up

1 Remove the doors, hinges, spring catches and clips, and the top (G). Finish-sand to 220 grit any areas that need it, and remove the dust.

2 Apply a stain and clear finish. We applied Varathane no. 266 Early American Stain, followed by three coats of AquaZar Water-Based Clear Satin Protective Finish, sanding to 320 grit between coats.

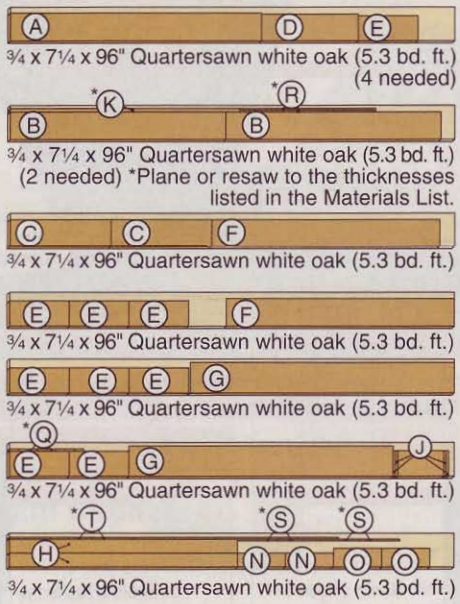
3 Install the glass and glass stops (R, S, and T) in the back of the doors with #17×¾" brads. Place a piece of cardboard on the glass to protect it when driving the brads.

4 Remount the top (G) and doors. Then mount the 1⅛" ring pulls and keyhole escutcheons on the inner door stiles (M) [**Drawings 2** and **3**] using the supplied fasteners. To create faux keyhole openings on the stiles, trace the shape of the escutcheon keyhole slot onto each stile with a fine-tip, permanent black marker, and fill in the outline.

5 Finally, position the back (L) in its opening, and drive the #17×¾" wire nails [**Drawing 2**]. Move the bookcase to the desired location. Then install the adjustable center and side shelves (D, E) using ¼" brass paddle supports. Now step back and admire your workmanship, and keep the faux-tenon secret to yourself.

Written by **Owen Duvall** with **Chuck Hedlund**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

Cutting Diagram


A D E
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.) (4 needed)
*K *R
B B
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.) (2 needed) *Plane or resaw to the thicknesses listed in the Materials List.
C C F
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)
E E E F
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)
E E E G
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)
*Q J
E E G
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)
*T *S *S
H N N O O
¾ x 7¼ x 96" Quartersawn white oak (5.3 bd. ft.)

Materials List

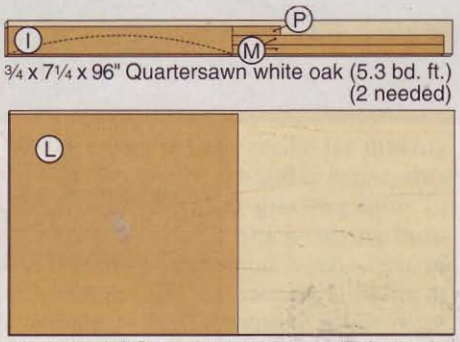
Case		FINISHED SIZE T	W	L	Matl.	Qty.
A	sides	¾"	12"	54¼"	EQO	2
B	dividers	¾"	11¾"	46½"	EQO	2
C	fixed center shelf	¾"	11¾"	21¾"	EQO	1
D	adjustable center shelves	¾"	11½"	20⅞"	EQO	2
E	adjustable side shelves	¾"	10¾"	12⅞"	EQO	6
F	bottom	¾"	11¾"	49¼"	EQO	1
G	top	¾"	13"	57"	EQO	1
H	cleats	¾"	3"	49¼"	QO	2
I	bottom rails	¾"	6"	48½"	QO	2
J*	faux tenons	¾"	5½"	⅜"	QO	4
K	trim	⅜"	¾"	49½"	QO	2
L	back	¼"	47¼"	49¼"	QOP	1
Doors (2 needed)						
M	stiles	¾"	2"	45⅝"	QO	4
N	top rails	¾"	3"	10⅜"	QO	2
O	bottom rails	¾"	4"	10⅜"	QO	2
P	center rails	¾"	2"	10⅜"	QO	2
Q	groove fillers	¼"	¼"	2"	QO	8
R	bottom vertical glass stops	⅜"	⅜"	29⅜"	QO	4
S	top vertical glass stops	⅜"	⅜"	8¾"	QO	4
T	horizontal glass stops	⅜"	⅜"	8⅞"	QO	8

*Part initially cut oversize. See the instructions.

Materials key: EQO–edge-joined quartersawn white oak, QO–quartersawn white oak, QOP–quartersawn white oak plywood.
Supplies: #8×1¼" and #8×1½" flathead wood screws, #8×1¼" panhead screws, #8 flat washers, #17×¾" and #17×1" brads, #17×¾" wire nails, ⅛×9½×8⅜" glass (2) and ⅛×9½×29¼" glass (2), 2¼" partial-wrap inset hinges (6), 1¼" spring catches with clips (4), ¼" brass paddle supports (32).
Blade and bits: Dado-blade set; ⅛" and ¼" roundover, 45° chamfer, and ½" pattern router bits; ¼" brad-point bit.

Source

Hardware: 2¼" partial-wrap inset hinges with oil-rubbed bronze finish, no. 01H31.92, $3.40 each (6); 1¼" spring catches with clips, no. 00W11.02, $.85 each (4); 1⅛" ring pull with dark bronze finish, no. 01A28.44, $2.10 each (2); keyhole escutcheon with dark brown finish, no. 01A28.45, $1.10 each (2); ¼" brass paddle supports, no. 63Z06.04, $5.25 pkg. of 20 (2 pkgs.). Call or click Lee Valley, 800-871-8158; leevalley.com.



Build an All-Wood Suspended Ceiling

A super-simple yet elegant way to top off a finished basement

Woodworker Dave Knau needed a ceiling for his new basement rec room, but he wanted more than office-style acoustic panels and skinny metal grids. His solution: an all-wood ceiling that looks permanent, but disassembles for easy access to overhead wiring and plumbing.

Dave's simple system consists of only three groups of parts: wall-mounted strips for the perimeter of the room, grid pieces, and panels cut from ¼" plywood **[Drawing 1]**. Installation requires hardware available at most home centers.

Plan your ceiling grid

Unlike manufactured suspended ceilings limited to 2×2' or 2×4' panels and 1"-wide grids, you can customize the size, shape, and details of wooden ceiling panels to suit your space. When Dave planned the grid for the basement of his Windsor Heights, Iowa, home, he settled on center panels 30" square and 15×30" side panels to emphasize the long, narrow shape of the room that holds his shop-built 18-foot shuffleboard table (see *page 40*). When he helped build a friend's basement ceiling, though, he used 2'-square panels that efficiently used 4×8' plywood sheets.

To begin planning a ceiling, draw your room to scale on graph paper. (We'll use an 8×12' space for this example.) Measure the room from several locations and note bumps or dips in the walls. Mark the locations of overhead joists that might interfere with recessed lights. If you've ever laid a tile floor, you'll find the following planning pointers a snap. This is even easier because you can customize the panel sizes.

Draw two centerlines the length and width of the room, as shown in red **[Drawing 2]**. Then divide the space into squares representing the panels (as shown in blue) starting with whole

FRAME AROUND OBSTRUCTIONS

squares along the centerlines. A 2'-square panel provides a good starting point for your plans, but you can increase or decrease the grid size and shape to fill the ceiling with equal-size panels.

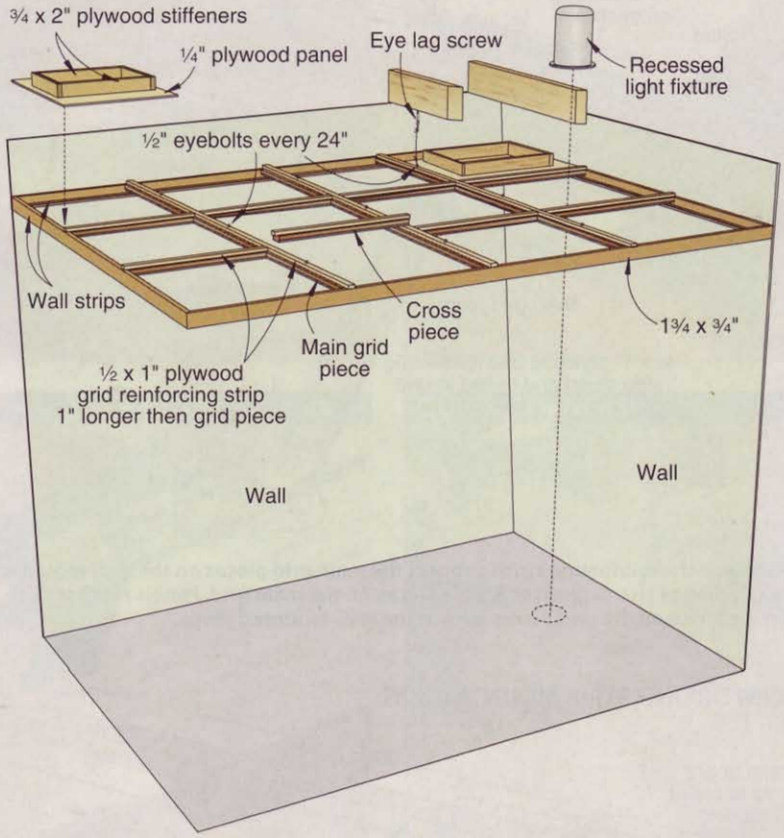
If you end up with slivers of a grid space along two or four walls, redraw your grid layout to place rows of panels centered on the center lines and work toward the edges. You'll still have partial panels along the walls, but they'll be at least half the width and length of the full-size panels.

As you map the room, draw in where you'll insert overhead lights and heating vents on individual panels **[Drawing 3]**. If necessary, vary the grid sizes to work around obstacles or accommodate recessed lights, as Dave did. Include any low-hanging obstructions, such as ducts or pipes. This ceiling will hang about 4" beneath the joists, so you may need to frame around obstructions, as shown *above*, and enclose them with drywall to avoid dropping the entire ceiling uncomfortably low.

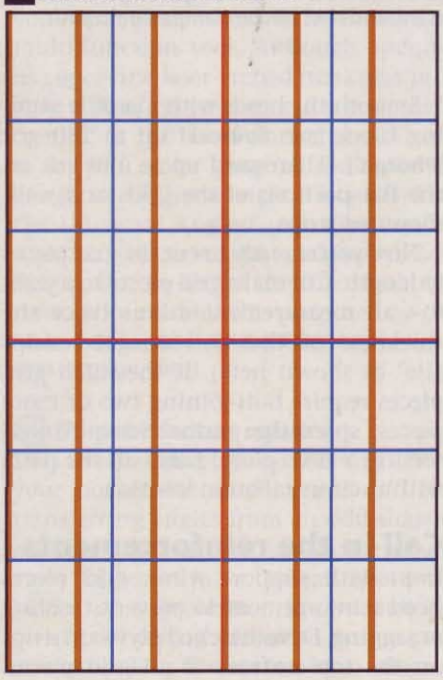
For minimal butt joints, plan the wall-to-wall, or main, grid pieces to span the shortest dimension of the room. Then letter and number the grid lines on your drawing. In this example, the numbered lines represent the main grid pieces, and the letters indicate the positions of short cross pieces that hang between the main grid pieces to separate the panels. When you're satisfied with the layout, mark the walls where pieces will go with the mounting location, the letter or number of the part, and the wall-to-wall measurement indicating its length.

Before you begin making and hanging ceiling parts, wire the room for lights you'll install. Then modify or add to your ductwork to heat and cool the space. Connect vents mounted on ceiling panels to nearby metal ducts with flexible hose.

1 EXPLODED VIEW OF SUSPENDED CEILING

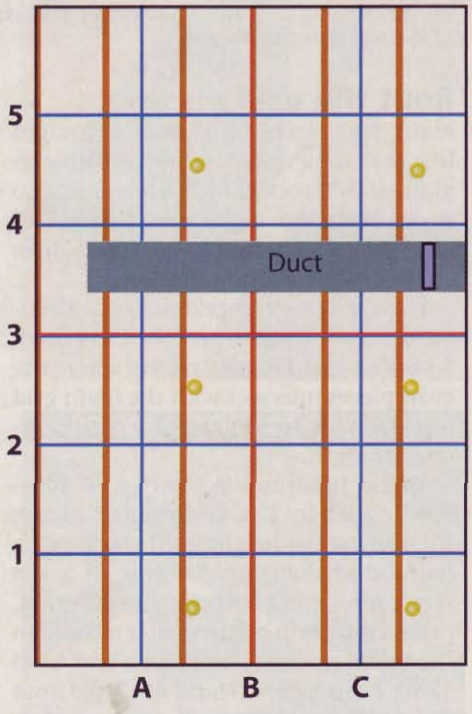


2 CEILING GRID LAYOUT



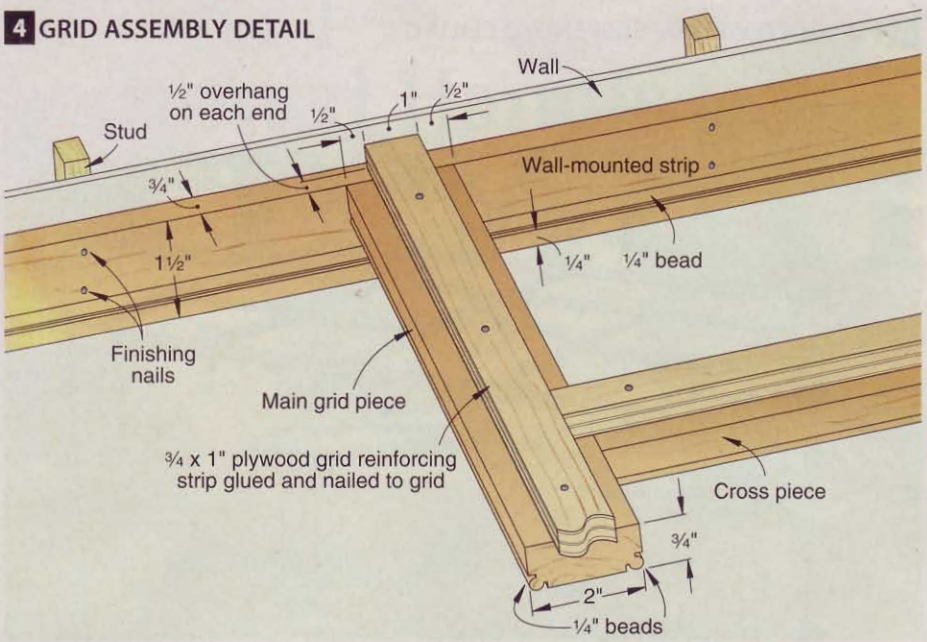
Room boundaries
Overhead joists
Centerlines/gridlines
Grid locations

3 MARK LIGHTS AND OBSTACLES



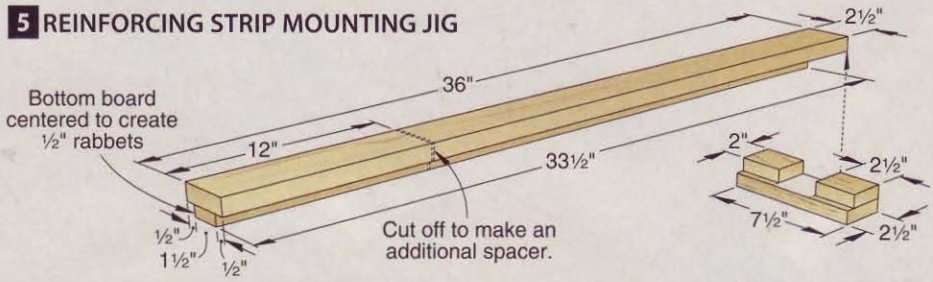
Number the locations of the main grid pieces and letter the locations of cross pieces. Then plan the locations for any recessed lights (in yellow) and obstacles, such as ducts.

4 GRID ASSEMBLY DETAIL



Overhangs on the reinforcing strips support the main grid pieces on the wall-mounted strips. Similar overhangs also support the cross pieces on the main grid. Panels rest between the reinforcing strips on the grid pieces and on the wall-mounted strips.

5 REINFORCING STRIP MOUNTING JIG



Vary the length of this jig to suit the grid strips you'll reinforce. For grid strips longer than the jig, build the jig long enough to cut a 1' piece from the end that can be clamped onto your glue-up at the opposite end.

Rout the grid pieces

Main grid pieces must hold a straight line over long distances, so use straight-grained ¾" stock. Rip 2"-wide strips to make both the main grid pieces and cross pieces. Then rip 1½"-wide blanks to make the wall-mounted strips.

You can leave the grid pieces undecorated or vary from the profile Dave used. A beaded edge looks attractive where the cross pieces intersect with the main grid pieces, and it doesn't sacrifice panel support strength.

To cut this profile, insert a ¼" edge-beading bit in a table-mounted router; then adjust the height until you create a half-round shape on the edge of a test scrap. After you fine-tune the bit height, place a grid strip on the router table with the best face down, and rout a half-bead along both edges **[Photo A]**. Then rout the workpieces vertically to complete both beads **[Photo B]**. For the wall-mounted strips, follow the same routine, but only on one edge.

Smooth the beads with a profile sanding block (see **Sources**) up to 180 grit **[Photo C]**. Then sand up to 180 grit on the flat portions of the grids and wall-mounted strips.

Now you're ready to cut the grid pieces to length. Cut main grid pieces to a wall-to-wall measurement minus twice the thickness of the wall-mounted strips (1½" as shown here). If the main grid pieces require butt-joining two or more pieces, space the joints to avoid intersecting a cross piece. Label all the parts with their installation location.

Call in the reinforcements

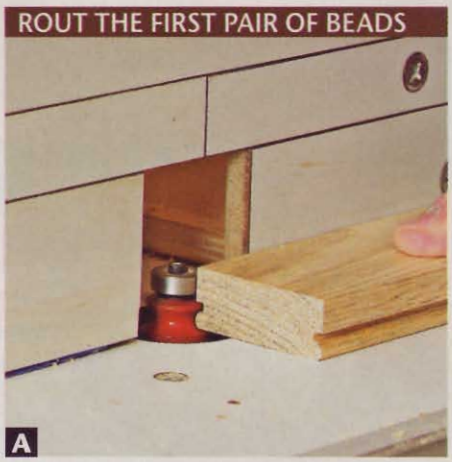
Even with support wires, grid pieces need reinforcement to prevent twisting or sagging. Dave attached plywood strips on the top surfaces of all grid pieces. These strips also separate, position, and support the panels.

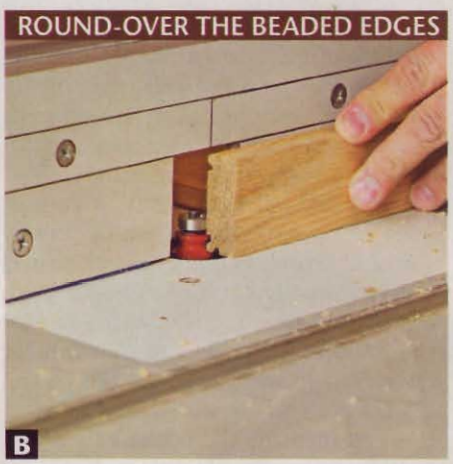
From ¾" B-C plywood, rip 1"-wide grid reinforcement strips. The 1" width creates no wood movement problems on 2"-wide hardwood, but avoid using strips wider than 1" on hardwood grid pieces wider than 2".

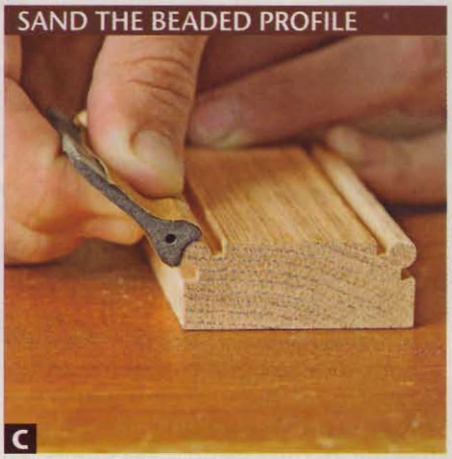
Don't worry if even 8' reinforcement strips don't span your main grid pieces. Just butt strips together, making sure any reinforcement-strip butt joint falls at least 1' from a butt joint in the main grid piece.

Cut each plywood reinforcement strip, or combination of strips, 1" longer than the hardwood grid piece below it to leave ½" overhangs on both ends.

To save time gluing plywood strips to grid pieces, make a reinforcing strip mounting jig **[Drawing 5]** that centers







the plywood strip on the hardwood grid piece, and leaves the ½" overhang. Glue and nail the strips to the grid pieces **[Photo D]**. A pneumatic nailer with 1¼" brads simplifies the job.

Now make the panels

For a light surface that reflects light and contrasts with the oak grid, Dave made his ceiling panels from ¼" birch plywood. As another time-saver, he sprayed a clear film finish on all of one side of a plywood sheet before he cut the ceiling panels to length and width.

To calculate the panel length, add 1" (for the two overhangs) to the distances between edges of the main grid pieces. Cross-cut the plywood sheets to these lengths; then cut the center panels to width according to your grid layout, again adding 1" for the overhangs. From the remaining blanks that you cut to length, cut edge panels for one side of the room to width plus 1". Cut pieces for the other edge of the room about ¼" wider than necessary to fine-tune the fit during final assembly. This way, the cross grid pieces will form a straight line down the length of the room, as they did in Dave's rec room.

From Dave's experience, ¼" plywood panels can sag with time. To keep them flat, attach four 2"-wide stiffeners of ¾" plywood on edge atop each panel about 2" from the edges **[Photo E]**. You can save time by reinforcing two or more panels at once. First, glue and apply the four reinforcing strips to a panel resting on a flat surface. Next, place the second panel directly over the glue-up. Glue another four reinforcing strips, and position them on the panel. Repeat this up to four times; then cover the stack with a scrap of ¾" plywood the size of your ceiling panels. Weight the top sheet **[Photo F]** and allow the glue to dry.

ATTACH REINFORCING STRIPS

D

MARK THE WALL STRIP HEIGHT

G

STACK PANELS WITH STIFFENERS

E

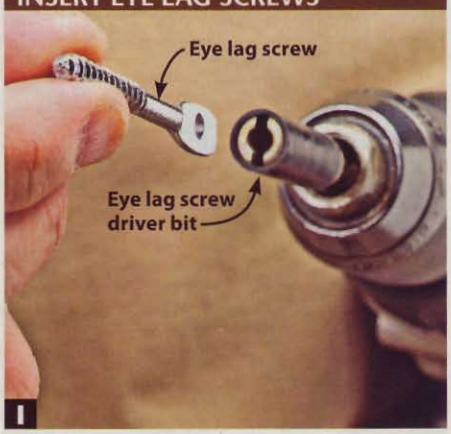
NAIL WALL STRIPS IN PLACE

H

WEIGHT THE PANEL GLUE-UPS

F

INSERT EYE LAG SCREWS



I

Hang the ceiling grid

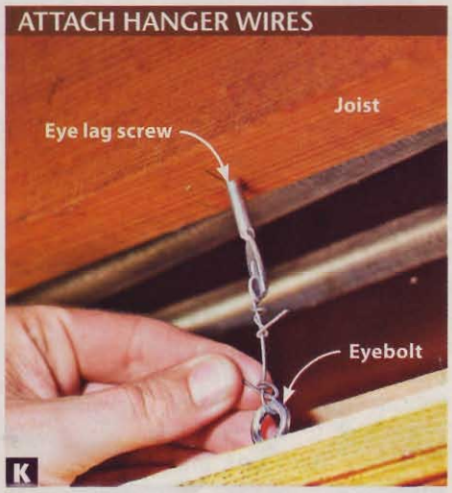
To install the wall-mounted strips, measure down at least 4" from the lower edges of the overhead joists, and mark a level line the length of the wall. You can use a chalk string and level for this, but it's faster to use a self-leveling laser level **[Photo G]** suspended from the ceiling. (See **Sources**.) Use your first line as the starting point for marking the remaining level lines around the room. Cut the wall-mounted strips to fit, and then nail them in place with the top edges at the level line **[Photo H]**.

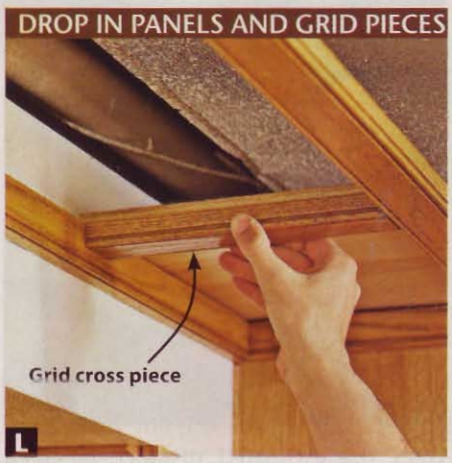
Where each main grid piece will hang, stretch a string from one side of the room to the other. Roughly every 4', insert an eye lag screw (see **Sources**) into the subfloor or joist directly above the string. A driver bit made to hold these screws **[Photo I]** simplifies the job. To work around pipes, ducts, and other obstructions, reduce the space between lag screws as needed. But avoid spacing them further apart.

Next, drill 7/64" pilot holes into the main grid reinforcing strips to correspond with the positions of the eye lag screws. Insert each 1⅜" eyebolt to the same depth.

To support the main grid pieces, cut lengths of 12-gauge wire about 6" longer than the estimated distance between the eyes of the lag screws and the main grid eyebolts. Thread a wire through each eye lag screw and twist the end to hold it in place.

To determine where to bend the wires for even support of the main grid pieces, measure from the top surface of the hardwood portion of the grid to the top inside portion of an eyebolt in the reinforcing strip. At that distance above the top of the wall-mounted strips, stretch a taut string or position a laser level to intersect the wires hanging from the eye lag screws. Bend each wire 90° where it touches the string or laser line.





Starting at one end of the room, support the first main grid piece on the wall-mounted strips using the overhang on the reinforcing strips **[Photo J** and **Drawing 4]**. Then thread a support wire through each eyebolt and twist the end to hold it in place **[Photo K]**.

Hang the first panel between the wall strip and main grid piece, and slide it to one corner. Add a grid cross piece **[Photo L]**, followed by another panel, and repeat until you reach the end of the row. If you fine-tune the last panel in a row, note which side of the room required the fitted panel. By fitting only the panels on that side, your grid cross pieces form a straight line as they're installed, as shown on *page 36*.

Then hang your second main grid piece, followed by panels and cross-pieces. Repeat the process until you reach the opposite end of the room, attaching any recessed light fixtures or air ducts in the panels as you work.

Shop-Built Shuffleboard Tables

Dave Knau's suspended ceiling is the perfect complement to his other woodworking specialty: building shuffleboard tables. His rec room holds one measuring nearly 21' long, 32" wide, and 34" tall.

Dave's interest in making an indoor shuffleboard table started when a friend planning to buy one discovered that the commercial versions either cost thousands of dollars or were poorly made from plastic-covered particleboard. Since that first table, Dave has made four others.

Each table has three main assemblies: the playing surface, or game board, on which the 8-ounce weights glide; the table that supports the game board; and the legs holding up the table. Dave used two layers of ¾" plywood topped with a ½"-thick glue-up of maple pieces to make the 18'-long, 20"-wide game board for his table shown *below*. Scoring and foul lines on the table are inlaid walnut for contrast. To keep the game board dead-flat, he ran the assembly through a drum sander.

"It's not hard to do," Dave says. "What's intimidating is the size: You have to have a place to assemble it."

Dave Knau

Dave made the sides of the table from cherry-veneer plywood with maple trim attached using chrome screws and trim rings. The rounded corners, shown in the inset *below*, were formed from six layers of ⅛" bendable plywood pressed together around a 4"-diameter PVC pipe in a shop-built jig. He then covered the glue-ups with cherry veneer to match the plywood sides. In addition to supporting the game board, the table surrounds it with a 6" trough to catch any stray weights during play and the surplus powdered wax that lubricates the playing surface.

Five pairs of walnut legs each have levelers recessed into them to stabilize the table. His next shuffleboard table—still in the planning stage—will rest on a base of storage cabinets.

Sources

Profile sanding blocks. Set of five concave sanding grips no. 68Z82.02, $4.95, call Lee Valley Tools at 800-871-8158; leevalley.com.

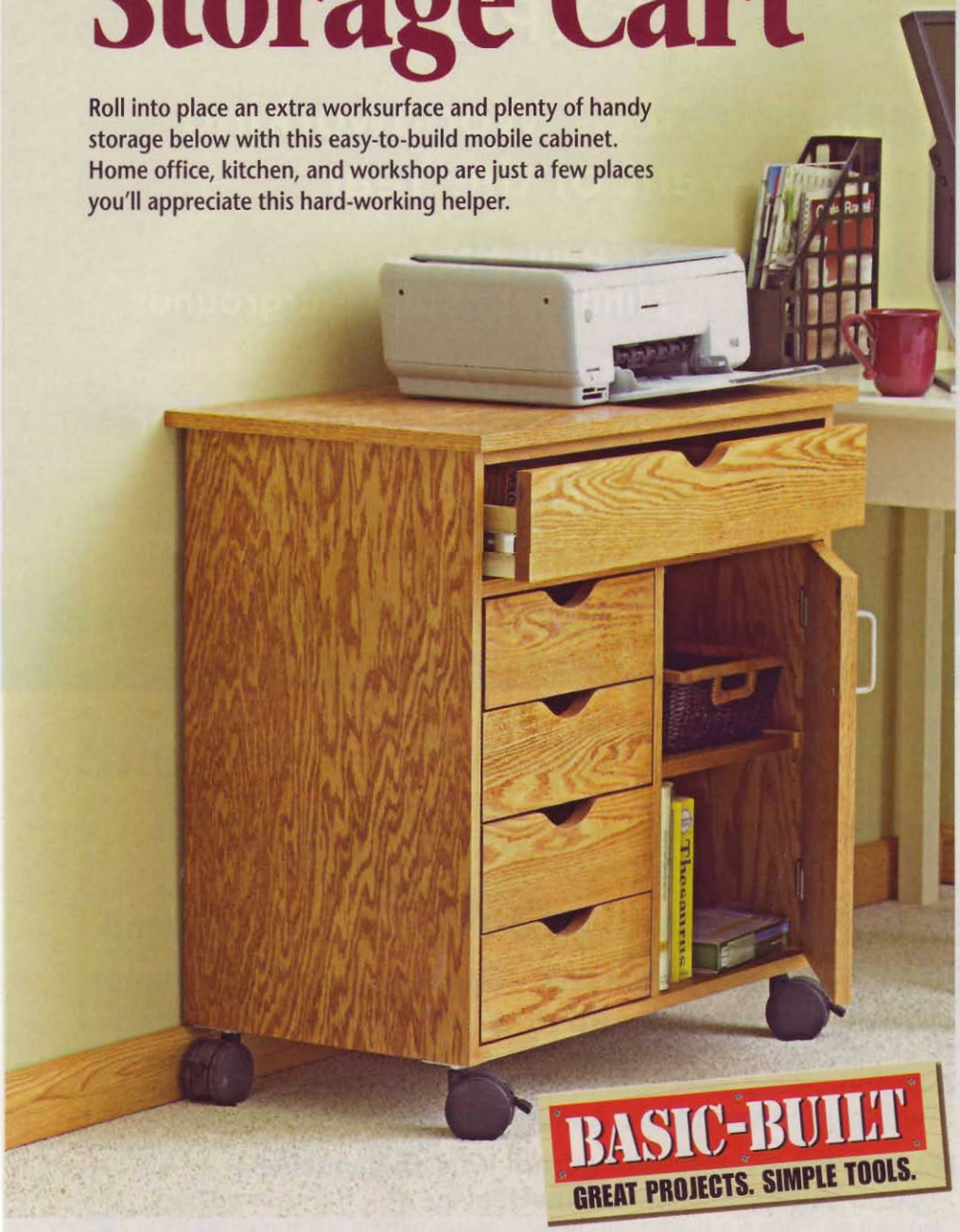
Laser level. Projected CrossFire Auto Level Laser no. BDL310S, $80, call Black & Decker at 800-544-6986; blackanddecker.com.

Eye lag screws. Buy at home centers or no. KZR2MN from Hardware World, $6.93 for 100; hardwareworld.com.

Eye lag screw driver bit. Available at home centers, or no. GJXKHS from Hardware World, $4.38.

Home/Shop Storage Cart

Roll into place an extra worksurface and plenty of handy storage below with this easy-to-build mobile cabinet. Home office, kitchen, and workshop are just a few places you'll appreciate this hard-working helper.



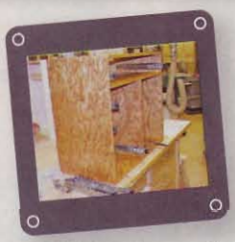
BASIC-BUILT
GREAT PROJECTS. SIMPLE TOOLS.

PROJECT HIGHLIGHTS

- Overall dimensions: 31" wide × 17¼" deep × approximately 31" high.
- Biscuit-and-screw joinery make the cart super-simple to assemble.
- Except for the top, which has solid-wood edging, all other exposed plywood edges are banded with easy-to-apply iron-on veneer edging. For help with this process, go to woodmagazine.com/videos.
- You'll find all of the items needed to build the cart (hardware, ¾" and ¼" plywood, and ¾" poplar and oak) at your local home center.

Skill Builder

- Learn a handy trick for laying out biscuit-slot locations and accurately plunging slots into the face of a part.



See a Slide Show of this project coming together at: woodmagazine.com/slides

Start with the case

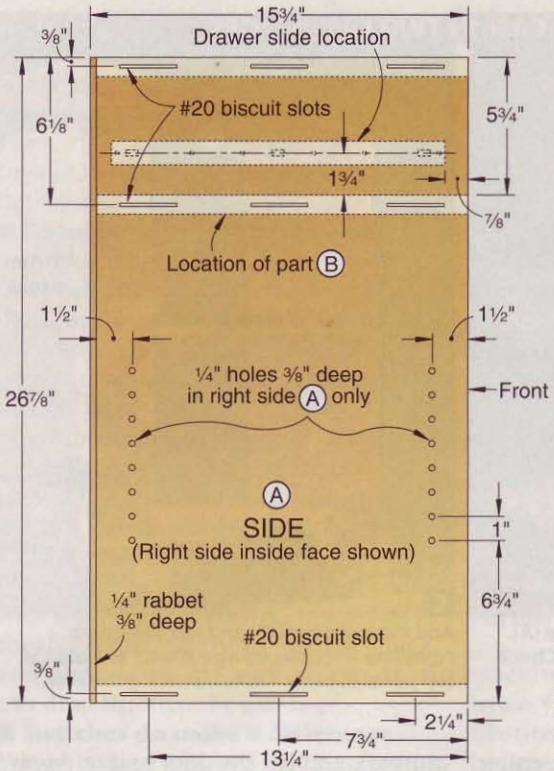
1 Cut the sides (A) and panels (B) to the sizes listed [**Materials List**, *page 46*]. Cut the divider (C) and shelf (D) to the sizes listed except ¼" longer to enable trimming later for a precise fit in the assembled case.

2 From ⅞"-wide iron-on veneer edging (available at your local home center), cut strips 1" longer than the lengths of the sides (A), panels (B), divider (C), and shelf (D) for the front edges. Using a household iron at the "cotton" setting, apply the veneer to the edges of the parts with an equal overhang on the faces and ends. Move the iron slowly enough to melt the adhesive but not burn the veneer. (You'll feel a slight "give" when the adhesive melts.) Before the adhesive sets, press the edging firmly into place

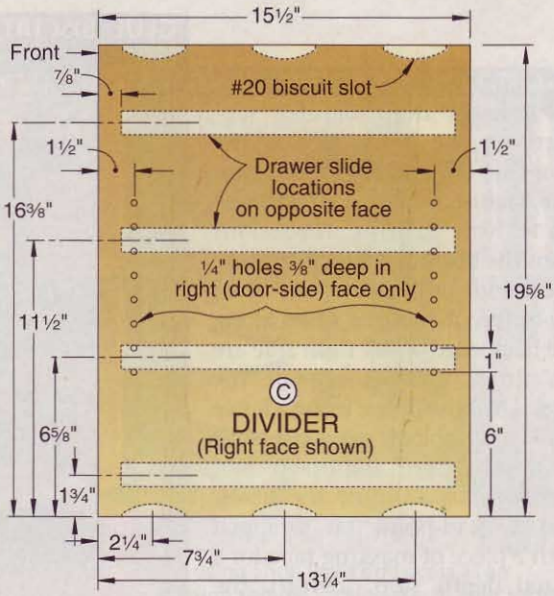
How to make a shop version of the cart

Need a mobile storage unit for your shop to keep tools and supplies organized and easy to move about? Design Editor Jeff Mertz built the one shown at *left* by making a few simple changes to the home cart:

- Substitute less-expensive birch plywood (or other void-free plywood of your choice) for the oak plywood and poplar instead of oak for the edging on the top.
- Omit the veneer edging on the exposed plywood edges.
- Size the door (which does not get veneer edging) by measuring the opening and subtracting ⅛" from the width and height to allow 1/16" clearance all around.
- For the large- and small-drawer faces (L, M), eliminate the curved cut-outs and mount 4" wire pulls instead (six needed, including the door).
- When finishing the cart, skip the stain and apply three coats of a clear finish only.



Note: Left side (A) is a mirror image.



using a 1"-long wood roller. (A wallpaper seam roller works great.) Now trim the edging flush with the faces and ends of the parts [**Photo A**]. Set the shelf aside.

3 Using a dado blade in your tablesaw or a rabbeting bit in your router, machine a ¼" rabbet ⅜" deep along the *back* edge of each side (A) on the *inside* face [**Drawing 1**] to receive the plywood back (E) [**Drawing 2**].

4 Draw centerlines for the #20 biscuit slots on the sides (A), panels (B), and divider (C), where dimensioned [**Drawings 1** and **2**]. Note that although the parts are not the same width, the locations of the slots are identical from their *front* edges. For a quick and easy way to accurately mark the centerlines, and plunge the face slots into the centers of the sides and center and bottom panels, see the **Shop Tip**, *below*. Plunge the slots into all of the parts except the divider. You'll plunge its slots after you cut the part to exact length.

5 Dry-assemble (no glue) and clamp together the sides (A) and panels (B) with #20 biscuits. Measure the diagonals of the case to ensure square. Then measure between the bottom and center panels (B) for the exact length of the divider (C). Crosscut the divider to your measurement. Now plunge the biscuit slots into each end of the divider. Disassemble the case.

FLUSH-TRIM THE VENEER EDGING

Making several light passes with a sharp utility knife, trim the veneer edging flush with the faces and ends of the parts.

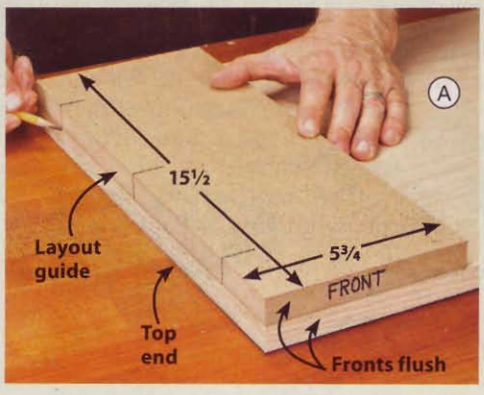
SHOP TIP

A simple aid makes biscuit layout pure gravy

When laying out biscuit-slot centerlines, you need to mark them precisely to ensure correct alignment of the parts. Rather than measuring for each slot, you can save time—and avoid errors—by making a layout guide (or storyboard). And, if you'll need to plunge slots into the faces of the parts, kill two birds with one stone by sizing the guide for use as a spacer when plunging these slots.

For example, to make a layout guide/spacer for plunging the face slots into the sides (A) for the center panel (B), cut a 5¾×15½" piece from ¾" scrap. The 5¾" width is the difference between the 6⅛" dimension from the top of the side to the biscuit-slot centerlines **[Drawing 1]** and the ⅜" offset from your biscuit-joiner base to the center of the cutter. The 15½" length is the width of the panel **[Drawing 2]**. Identify one end of the guide "front." Then draw centerlines for the three biscuit-slot locations, where dimensioned for the bottom panel, across a long edge.

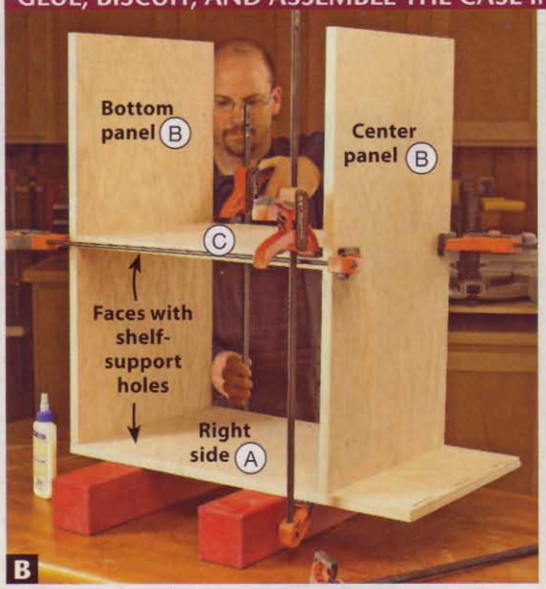
To put the guide to use, align the front end with the front edge of each part (the parts are not all the same width), and transfer the biscuit-slot centerlines at each end, as shown *below*. After marking the top end of each side, simply flip the guide over to draw the centerlines on the face for mounting the center panel. To plunge the face slots in the side for the center panel, align and clamp the guide to the side, as shown *below*. You also can use the guide as a spacer when plunging the slots in the faces of the center and bottom panels for the divider (C), but you'll need to position the guide ⅜" from the centerlines and place the assembly on spacers for clamping.



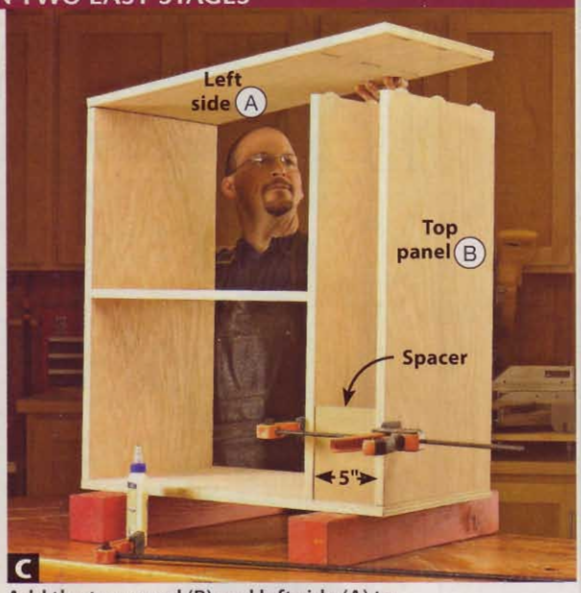
6 Mark centerpoints for ¼" holes ⅜" deep for shelf supports on the *inside* face of the *right* side (A) and the *right* (door-side) face of the divider (C) [**Drawing 1**]. Note that the dimensions from the bottom edges of the side and divider to the bottom holes are different, and the holes along the back edge of the right side are 1½" from the rabbet—not the edge. Drill the holes, using a fence with a stopblock on your drill press to ensure alignment and consistent spacing of the holes, and a brad-point bit wrapped with a piece of masking tape for a visual depth stop. Identify the bottom edge of the divider to ensure correct orientation during case assembly.

7 Sand the case parts to 180 grit. Then glue, biscuit, and clamp together the right side (A), bottom and center panels (B), and divider (C) [**Photo B**]. Ensure correct orientation of the divider with the side that has holes for the shelf supports facing the right side, and the bottom edge against the bottom panel. To make it easy to complete the case assembly, cut a 5×6" piece from ¾" scrap for a spacer. Using the spacer and a clamp to hold the top panel in position, glue, biscuit, and clamp the panel and left side in place to complete the case [**Photo C**].

GLUE, BISCUIT, AND ASSEMBLE THE CASE IN TWO EASY STAGES



Glue, biscuit, and clamp together the right side (A), bottom and center panels (B), and divider (C). Check the assembly for square.



Add the top panel (B) and left side (A) to complete the case, using a spacer to hold the top panel in place while installing the side.

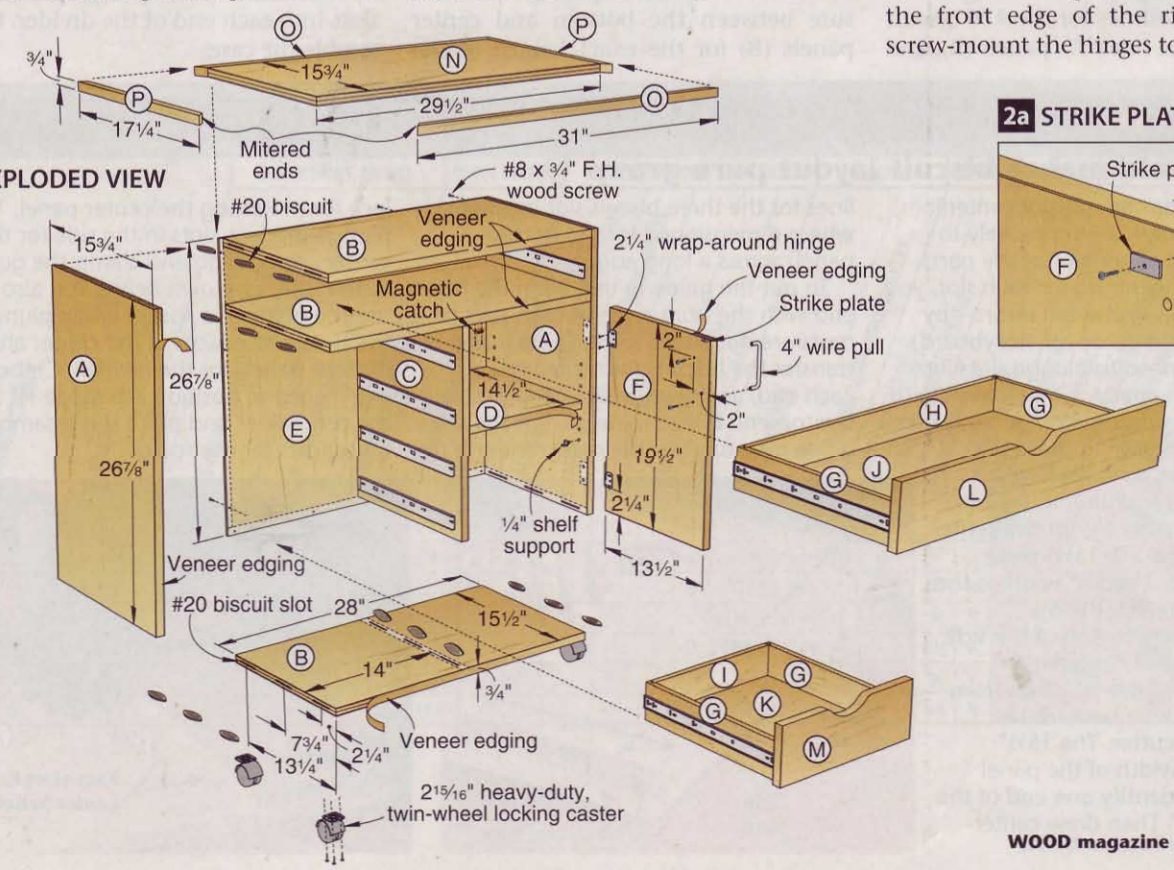
8 Measure the width of the opening between the divider (C) and right side (A). Then trim the length of the shelf (D) to your measurement less ⅛". Cut the back (E) to size to fit between the rabbeted edges of the sides (A). Sand the back smooth, and set it aside.

Let's add the door

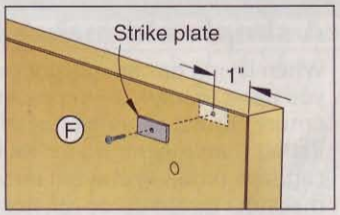
1 Determine the exact size for the door (F) by measuring the opening [**Photo D**]. Subtract ⅛" from each measurement (to allow a ⅛" reveal all around), and cut the door to size. Apply the edging. Sand the door smooth.

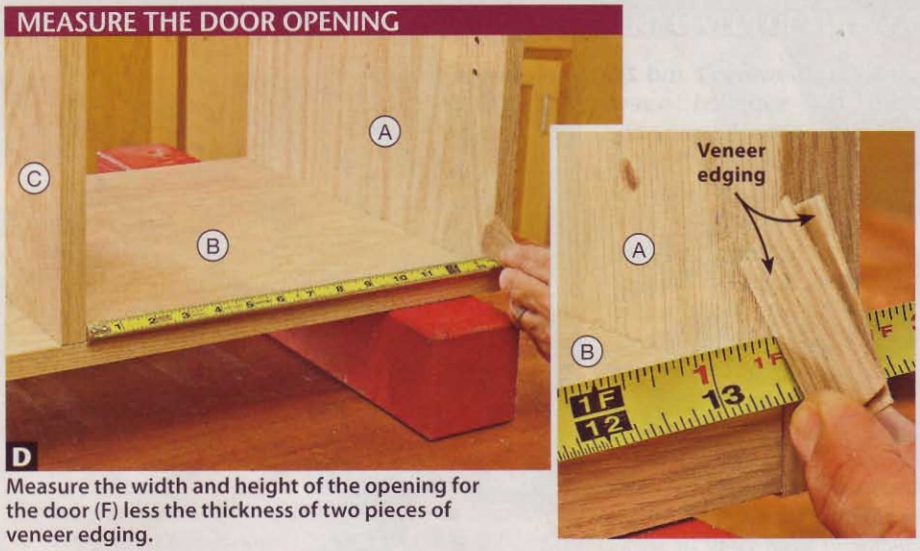
2 To mount the door (F), position two 2¼" wrap-around hinges on the door [**Drawing 2**]. Drill pilot holes, and fasten the hinges using the screws supplied with the hinges. Place the case on its right side. Then, to easily position the door in the opening, place 15⁄16"-tall spacers under the door and a 1⁄16"-thick spacer (to set the reveal) between an end of the door and the bottom panel (B) [**Photo E**]. With the hinge barrels tight against the front edge of the right side (A), screw-mount the hinges to the side.

2 EXPLODED VIEW

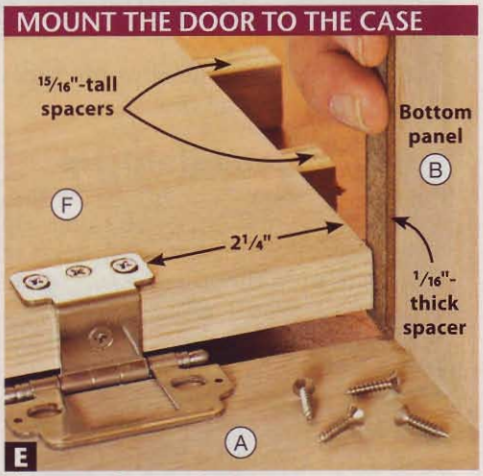


2a STRIKE PLATE DETAIL





Measure the width and height of the opening for the door (F) less the thickness of two pieces of veneer edging.



Elevate and center the door (F) in the case opening using 15/16"-tall and 1/16"-thick spacers. Mount the hinges to the side (A).

3 Remove the door and hinges. Lay out and drill holes for screw-mounting a 4" wire pull to the door [**Drawing 2**]. Set the door and hinges aside.

Now make the drawers

1 Cut the drawer sides (G) and large- and small-drawer fronts/backs (H, I), bottoms (J, K), and faces (L, M) to the sizes listed.

2 Using a dado blade in your tablesaw, cut the dadoes and rabbets into parts G, H, and I to form the lock-rabbet joint [**Drawing 3**]. Then cut the groove along the bottom edges of these parts to receive the large- and small-drawer bottoms (J, K). For help with the drawer assembly and installation, see *page 48*.

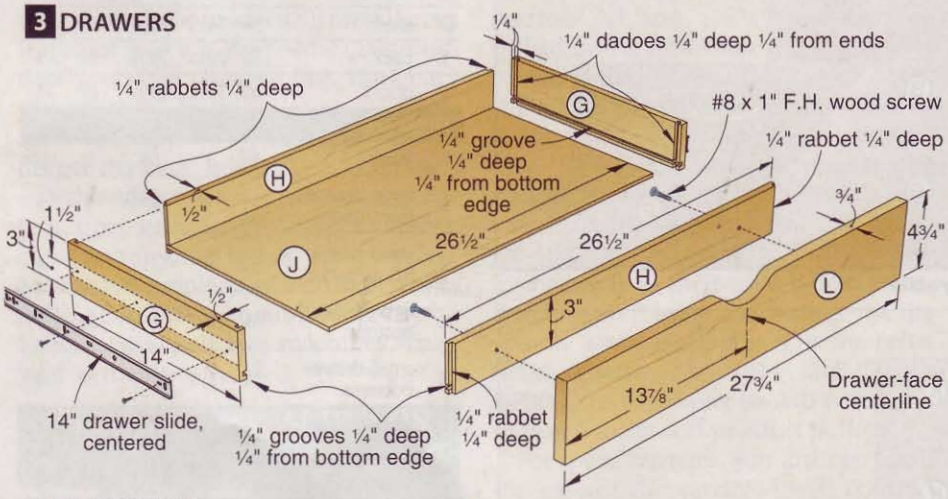
3 Sand all of the parts smooth. Then, glue, assemble, and clamp together the large drawer and four small drawers, checking each for square.

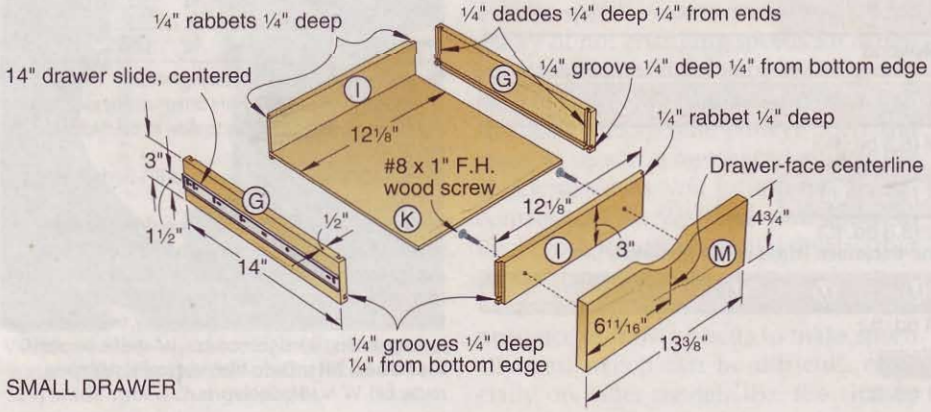
4 Separate the large and small members of five pairs of 14" drawer slides. Using a square, draw centerlines along the length of the drawer sides (G). Center a small slide member on each centerline. Mark the mounting holes. Now drill pilot holes, and drive the supplied screws.

5 To mount the large slide members in the case, draw centerlines on the sides (A) for the large drawer where dimensioned [**Drawing 1**], using a square. Then draw centerlines on the left (drawer-side) face of the divider (C) and the inside face of the left side (same locations as for the divider) for the small drawers, where dimensioned. Center the slides on the lines, 7/8" from the front edges of the sides and divider, and mount in place. (We cut spacers from 1/4" hardboard to the needed widths to easily position the slides for mounting.) Now slide in the drawers.

6 Make two copies of the drawer-pull full-size pattern from the *WOOD Patterns®* insert. Mark a centerline across the width of the large-drawer face (L) and one small-drawer face (M). Spray-adhere a pattern to each face, aligning the pattern and marked centerlines. Bandsaw and sand to the pattern line. Then, using the small-drawer face as a template, mark the remaining faces. Bandsaw and sand them to shape.

7 Apply a few pieces of double-faced tape to the back of the large- and small-drawer faces (L, M). Center the faces in the openings, and press them tightly against the drawer fronts. Remove the drawers. Then drill countersunk mounting holes through the fronts and into the faces [**Drawing 3**], and drive the screws. Remove the fronts and tape.





Reattach the fronts. Remove the slides from the drawers and case.

Top it off, and finish up

1 Cut the plywood top (N) to size. Then, from ¾" stock 36" long, rip three pieces that match the thickness of the top to form the front/back and side edging (O, P). You'll use two of the pieces for the front/back. Crosscut the remaining piece in half for the sides.

2 Miter-cut one end of each edging piece. Next, position a long and short piece against an edge and end of the top (N), with the mitered ends tight together. Mark the ends of the pieces for miter-cutting to the exact lengths [**Photo F**], transferring the marks on the heels onto the top faces. Trim the pieces. Then glue and clamp them to the top. Now fit and mark each of the remaining edging pieces. Miter-cut and mount them in the same way.

3 Sand the top (N/O/P) smooth. Then glue and clamp the top to the case, centering the top front-to-back and side-to-side.

4 Sand to 180 grit any areas that need it, and remove the dust. Apply a stain and finish. We applied Varathane no. 218 Traditional Pecan Stain followed by three coats of Minwax PolycrylicWater-Based Clear Satin Protective Finish, sanding to 220 grit between coats.

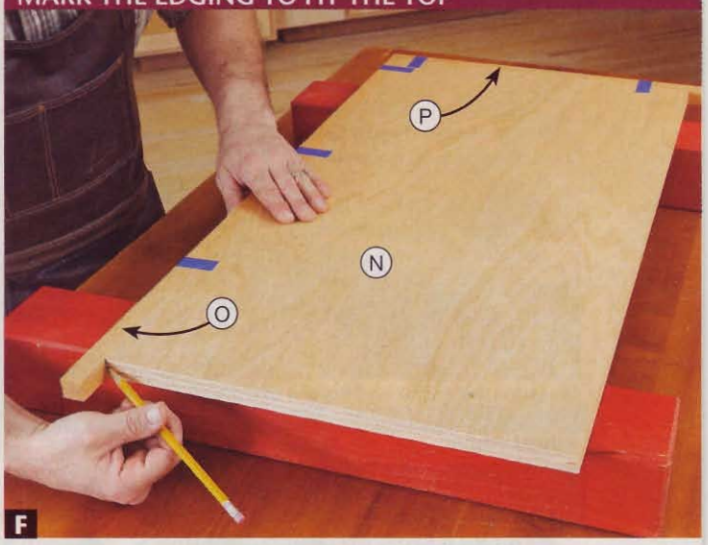
5 Place the cart with the bottom up. Position 2 15/16" heavy-duty, twin-wheel locking casters [**Drawing 2**] on the bottom, with the mounting plates ¼" from the case edges. Mark and drill the mounting holes. Then secure the casters with the supplied screws.

6 Remount the hinges, door, and wire pull. Slide in the drawers. Mount the strike plate for the magnetic catch on the back face of the door (F) [**Drawings 2** and **2a**] with the supplied screw. Close the door. Keeping the door flush with the front of the case, reach in from the back and position the magnetic catch, and mark the mounting holes on the center panel (B). Then screw-mount the catch.

7 Finally, position the back (E) onto the case. Drill the mounting holes through the back and into the case, and drive the screws [**Drawing 2**]. Now declutter your desk or shop, and load up the cart.

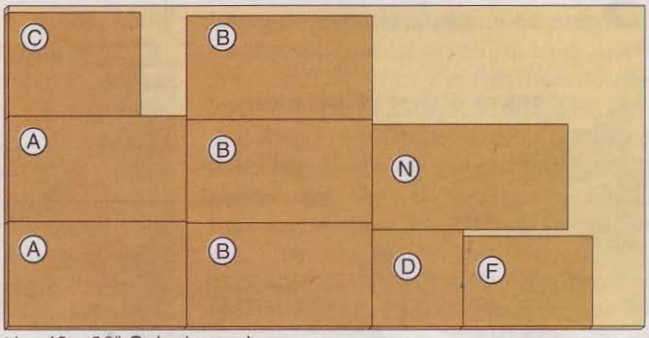
Written by **Owen Duvall**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

MARK THE EDGING TO FIT THE TOP

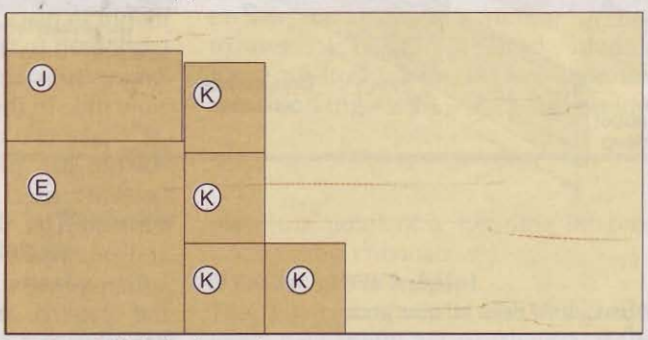


Tape pieces for the front (or back) and side edging (O, P) to the top (N). Mark the edging for the heels of the mitered ends.

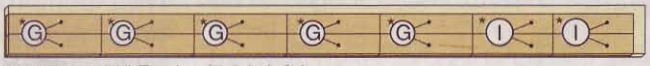
Cutting Diagram



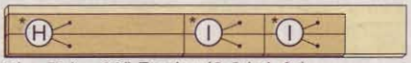
¾ x 48 x 96" Oak plywood



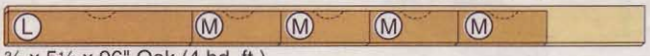
¼ x 48 x 96" Birch plywood



¾ x 7¼ x 96" Poplar (5.3 bd. ft.)



¾ x 7¼ x 60" Poplar (3.3 bd. ft.)
*Plane or resaw to the thickness listed in the Materials List.



¾ x 5½ x 96" Oak (4 bd. ft.)

¾ x 3½ x 36" Oak (1 bd. ft.)

Materials List

	Home cart	FINISHED SIZE T	W	L	Matl.	Qty.
A	sides	¾"	15¾"	26⅞"	OP	2
B	panels	¾"	15½"	28"	OP	3
C*	divider	¾"	15½"	19⅝"	OP	1
D*	shelf	¾"	14½"	13½"	OP	1
E	back	¼"	28¾"	26⅞"	BP	1
F	door†	¾"	13½"	19½"	OP	1
Drawers						
G	sides	½"	3"	14"	P	10
H	large-drawer front/back	½"	3"	26½"	P	2
I	small-drawer fronts/backs	½"	3"	12⅛"	P	8
J	large-drawer bottom	¼"	13½"	26½"	BP	1
K	small-drawer bottoms	¼"	13½"	12⅛"	BP	4
L	large-drawer face	¾"	4¾"	27¾"	O	1
M	small-drawer faces	¾"	4¾"	13⅜"	O	4
Top						
N	top	¾"	15¾"	29½"	OP	1
O*	front/back edging	¾"	¾"	31"	O	2
P*	side edging	¾"	¾"	17¼"	O	2

*Parts initially cut oversize. See the instructions.
†Exact door width and length are determined by measurement of the opening during assembly to allow for the thickness of the veneer edging.

Materials key: OP–oak plywood, BP–birch plywood, P–poplar, O–oak.

Supplies: ⅞"-wide iron-on veneer edging (approximately 21'); #20 biscuits; 1"-long wood roller; 2¼" wrap-around hinges (1 pr.); 4" wire pull; 14" drawer slides (5 prs.); spray adhesive; double-faced tape; #8x¾" and #8x1" flathead wood screws; 2 15/16" heavy-duty, twin-wheel locking casters (4); magnetic catch; ¼" shelf supports (4).

Blade and bits: Dado-blade set (or ⅜" rabbeting router bit), ¼" brad-point bit.

Make and Mount Super-Simple Drawers

If you can operate a tablesaw and drill, you can craft these sturdy inset drawers, suitable for any project from storage to fine furniture. We'll show you just how easy it is.

Watch FREE short videos on making drawers and mounting drawer slides at woodmagazine.com/videos.

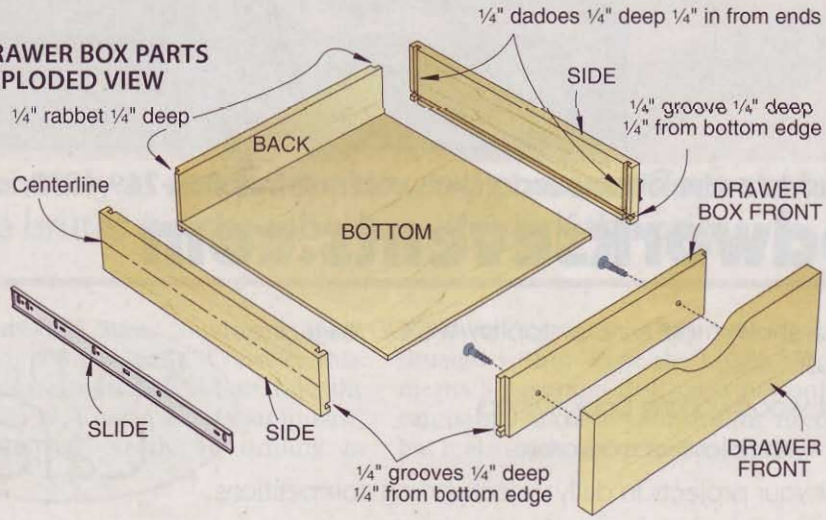
Limiting yourself to furniture projects without drawers is like trying to drive without using the steering wheel: Either way, you won't get far. But once you master how to measure, build, and mount these basic drawers, you're on the road to a world of furniture and storage projects.

Start with design decisions

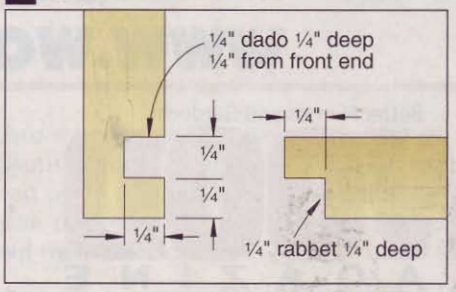
Two basic drawer styles will fit most project needs. Build inset drawers when you want the drawer front flush with the cabinet frame, as we did with the storage cart on *page 42*. Or build partial- or full-overlay drawers to conceal the frame with the drawer fronts. We'll focus on making inset drawers **[Drawing 1]**, the ones we use most often.

■ **Mounting.** Choose a drawer slide or other mounting method compatible with inset drawers. Of the dozens of options out there, the ones we use for most *WOOD®* magazine projects are full-extension slides, for their smooth

1 DRAWER BOX PARTS EXPLODED VIEW



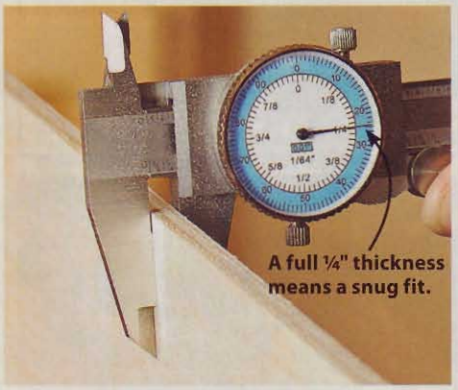
2 LOCK-RABBET JOINT



SHOP TIP

For grooves that fit, check drawer-bottom stock

Not all sheet goods sold as ¼" stock measure a true ¼" thick. If you don't discover that until after you cut the drawer bottom grooves, the rattle coming from your finished drawers will serve as a constant reminder. For example, the lauan plywood *below left* measures close to 13/64", thin enough to fit loosely. Even today's hardboard sheets measure too thin for a tight fit. The Baltic birch plywood, *below right*, comes closer to a true ¼", even though it's typically manufactured in metric dimensions (¼" equals 6.35mm). For another source of ¼"-thick drawer-bottom stock, try MDF-core plywood.

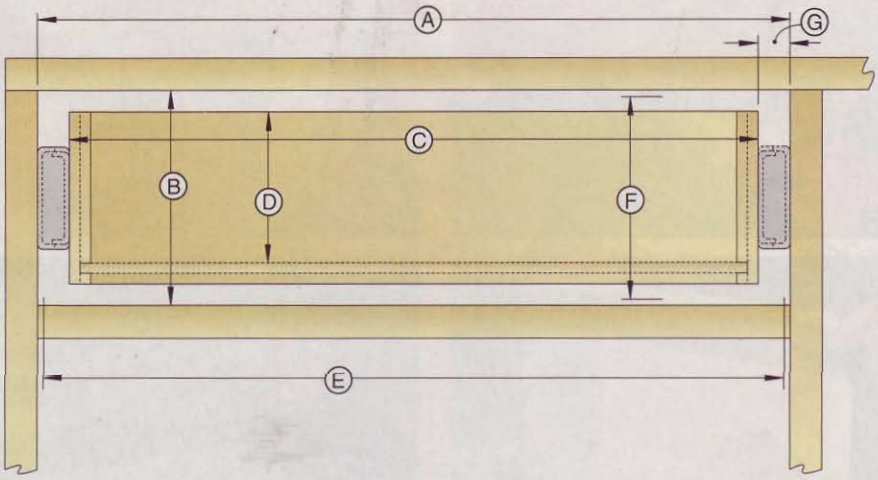


operation and easy access to drawer contents. See "Three Mounts that Count" on *page 51* for two other popular options: European-style slides and loose drawers that ride on low-friction tape.

■ **Materials.** Economize by making drawer boxes out of less-expensive materials than the rest of your project. We like poplar for its strength, light weight, and low price. For drawer bottoms, we prefer Baltic birch plywood. It's strong, doesn't expand like solid wood, and measures a consistent ¼" thick. (See the **Shop Tip** *above*.)

■ **Joinery.** Dovetails produce sturdy, attractive joints, but they're time-consuming. Lock-rabbet joints **[Drawing 2]** also provide plenty of mechanical and glue strength and can be cut quickly on a tablesaw without special jigs.

3 DRAWER MEASUREMENTS



Use this front view of a cabinet section to help calculate drawer-part sizes to fit your project:

- Drawer-box width: Ⓒ equals Ⓐ minus 1". (This assumes ½" drawer-slide clearances Ⓖ on each side. Check your drawer slide instructions for any variations.)
- For the drawer fronts, the length Ⓔ equals Ⓐ minus ¼" (for two ⅛" reveals). The width Ⓕ equals Ⓑ minus ¼".
- We show the drawer-box height Ⓕ with the same clearances as the width, but you can vary this to suit your preferences.

Size the drawer to fit the hole

Now, you're ready to calculate the drawer-box dimensions using the formulas in **Drawing 3**. Begin by measuring the cabinet opening width (A) and height (B). Full-extension slides typically require ½" clearance on each side, so calculate the box width (C) by subtracting 1" from dimension (A). The box height (D) can vary to suit your needs.

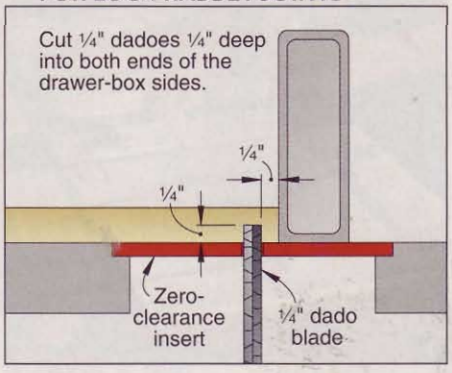
For an easy way to remember how long to cut your box parts to allow for the lock-rabbet joints, just subtract 1½" from (A) and from the box length. To calculate sizes for the drawer front, subtract ⅛" to ¼" from dimension (A) and (B) when using full-extension slides, or ¼" when using European-style slides.

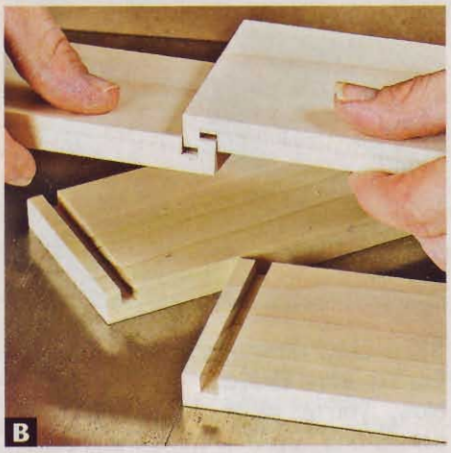
Cut the drawer-box parts

Consistent cuts yield tight-fitting, square drawers, so use stops instead of a measuring tape when cutting drawer parts to length **[Photo A]**. For a project with multiple drawers, cut all box fronts, backs, and side pieces in groups. Also, cut extra parts to test your setups to make the lock-rabbet joints.

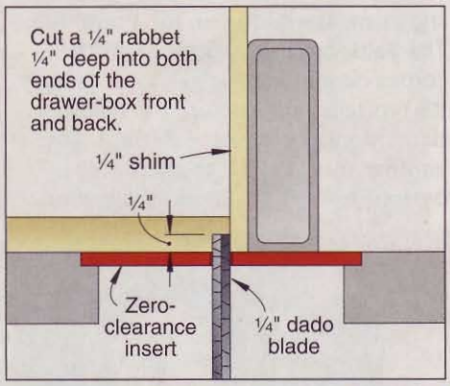
To dado the box sides for the lock-rabbet joint, first cut a 3"-wide spacer the length of your rip fence from ¼" stock. Install a ¼" dado blade, set the rip fence ¼" from the blade, and lock the blade ¼" high **[Drawing 4]**. To test the fence

4 DRAWER SIDE DADO SETUP FOR LOCK-RABBET JOINTS



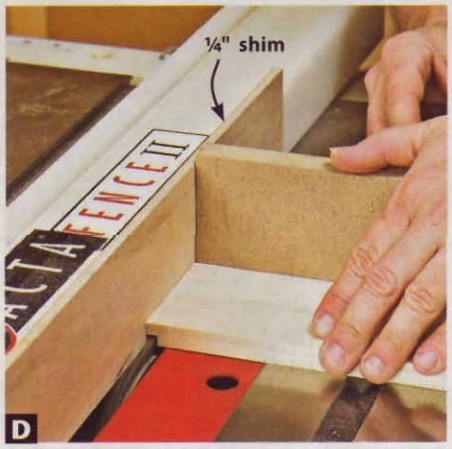


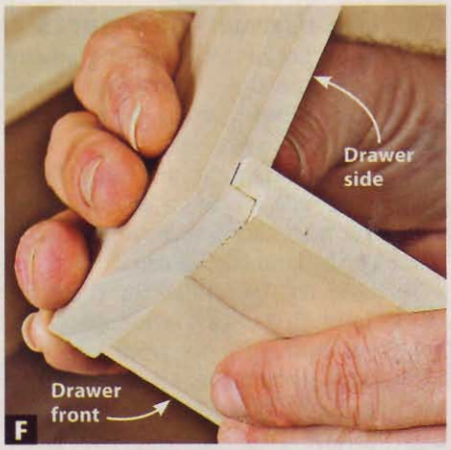
5 DRAWER FRONT AND BACK DADO SETUP FOR LOCK-RABBET JOINTS

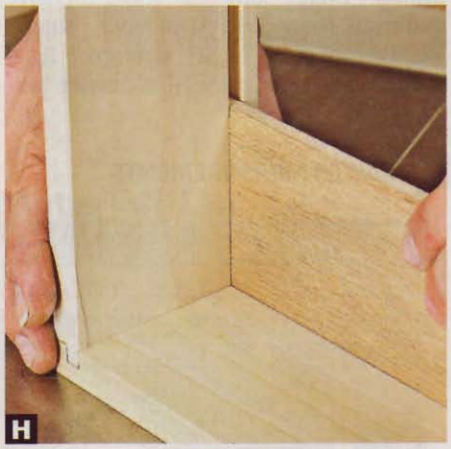


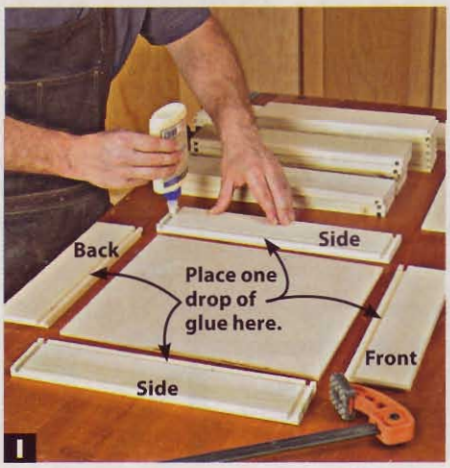
position and blade height, cut dadoes into two scraps **[Photo B]**, and check that they join snugly end-to-end. Once you achieve a tight fit, dado both ends of each drawer side **[Photo C]**.

To rabbet the box fronts and backs, attach the ¼" shim to the fence using double-face tape **[Drawing 5]**, and then rabbet the end of a scrap **[Photo D]** to test the fit with the dadoes cut in the previous step. Next, cut a rabbet on both ends of each drawer front and back. Fine-tune the fit using a block with 120-grit sandpaper on one face **[Photo E]**. The joint

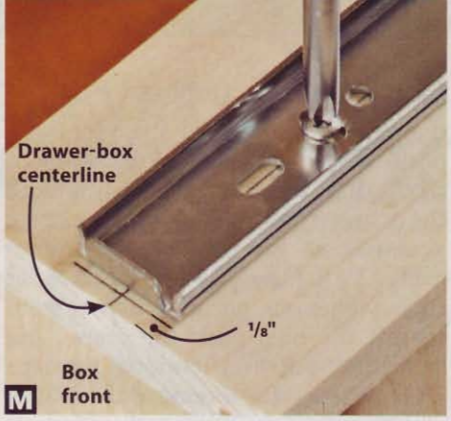








L



M

N

should fit together with moderate hand pressure **[Photo F]**.

To set up your tablesaw to cut the drawer-bottom grooves, simply remove the ¼" shim without moving the fence. Then, cut grooves into the inside faces of all four pieces of each box **[Photo G]**. Check the alignment of the box front, back, and sides using a piece of drawer-bottom scrap **[Photo H]**. Dry-assemble the box, and measure the inside length and width. Add 7/16" to each of those dimensions, and cut the drawer bottoms to that size.

To assemble the drawers, apply glue to both dadoes in a side piece **[Photo I]**. To keep plywood drawer bottoms from rattling, add a drop of glue at the center of each piece's drawer-bottom groove. Insert the front and back pieces into the dadoes on a side piece, add the drawer bottom and then the other side piece **[Photo J]**, and clamp all four joints. Measure both diagonals **[Photo K]** to verify that the boxes are square.

Install the drawers

To mount full-extension drawer slides, first measure and mark the cabinet or case with centerlines where each drawer slide will be mounted **[Photo L]**. Then, mark height centerlines on both sides of each drawer.

Next, remove the drawer-mounted part of the slide from the slide assembly that will mount on the case. The front of the case-mounted slide part rests 7/8" from the front edge of the case—¾" for the drawer front plus a 1/8" margin to keep the drawer slide from bottoming out as it closes. The box-mounted slide part mounts 1/8" from the front end of the box side.

Both the drawer-slide parts that attach to the cabinet and the part that attaches to the drawer **[Photo M]** use slotted holes to allow adjustments. Mark the locations of the mounting screws within these holes, drill 3/32" pilot holes (for #6 panhead screws) into the hardwood pieces, and mount the slide parts onto the drawers and the carcase **[Photo N]**, with the screws centered in the slotted holes. Now, insert the drawers, and check that the slides operate smoothly.

Attach the drawer fronts

Before attaching drawer fronts to the boxes, cut about a dozen 1×3" spacers from 1/16"-thick strips for full-extension

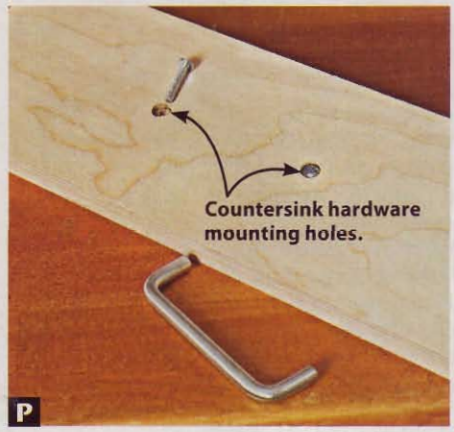
Three drawer mounts that count

Low-friction tape
Cost: $6.29–$22 per 10' roll, depending on material and thickness
Load capacity: As much as the drawer can hold.
Sizes: Widths range from ½"–3".
Variations: Some tape uses ultra-high molecular weight (UHMW) material instead of nylon.
Comments: Apply where the edges of the drawer sides ride on the carcase. Use this where you want a traditional drawer style without slides or mounts.

European-style slides
Cost: $2.15–$6.40 per pair for standard slides; $45–$60 for heavy-duty versions.
Load capacity: 55–100 lbs. Heavy-duty versions hold up to 220 lbs.
Sizes: 12"–26" long
Variations: White, brown, or almond slides come 10"–24" long in bottom/side-mount (shown) or side-mount versions.
Comments: An economical alternative to full-extension slides, they also require the same ½" side clearances. These slides allow more play in the drawer movement than full-extension slides, so use 1/8" reveals.

Full-extension slides
Cost: $7–$22.50 per pair for slides up to 100-lb capacity; up to $330 per pair for heavy-duty, 500-lb-capacity slides.
Load capacity: Most support 100 lbs.
Sizes: 12"–28" long in the 100-lb capacity
Variations: Over-travel slides support the drawer outside the cabinet. Self-closing slides pull the drawer fully closed. Mini slides fit a 3/8" side clearance for small projects.
Comments: Unlike the European-style slides, these don't have a right- or left-hand side. They allow less movement, permitting 1/16" reveals around inset drawers.

O



P

Q

R

drawer slides or 1/8"-thick strips for European-style slides. Attach double-faced tape to the box to temporarily mount the drawer front, and use spacers to leave a consistent gap around the drawer front. With the spacers inserted as shown **[Photo O]**, press the drawer front against the box, push the drawer out from the back, and reinforce the tape with a clamp. Then remove the drawer with the clamp still attached, and insert two mounting screws from inside the box, as shown on *page 48*. Repeat for the remaining drawer fronts.

If you want a knob or pull on the drawer front, remove the mounting screws, and detach the front from the box. Mark where you want the hardware, then drill the mounting-screw holes. Counterbore the holes into the back side of the drawer front so the screws sit flush **[Photo P]**. Use the holes to temporarily screw the drawer front to the box **[Photo Q]**, and reinsert the two mounting screws to attach the drawer front onto the box.

Once you've finished your project **[Photo R]**, you may need to fine-tune the slide adjustments. See "Troubleshoot Misaligned Drawers" *below* for tips on getting drawers flush and even.

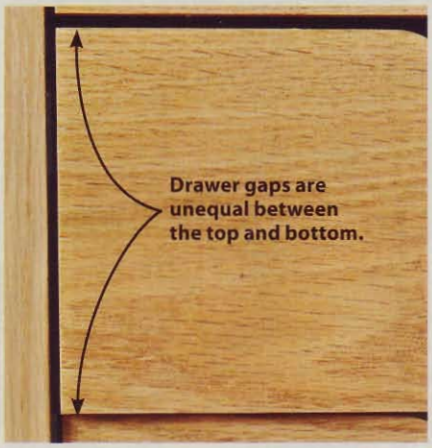
Sources

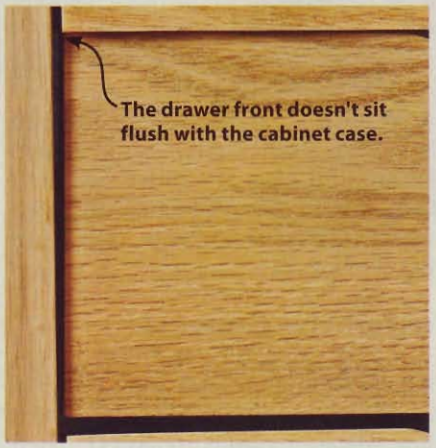
Low-friction drawer tape: Nylon tape no. 70615, $6.29 for a ½"x10' roll, call Rockler Woodworking and Hardware at 800-279-4441; rockler.com. Ultra-high molecular weight tape no. 25U04.01, $10.30 for a 1"x18' roll, call Lee Valley Tools at 800-871-8158; leevalley.com.

Drawer slides: Full-extension and European-style slides in a variety of sizes and styles are available from Rockler Woodworking and Hardware; Lee Valley Tools; Grizzly Industrial, 800-523-4777, or grizzly.com; and Woodcraft, 800-225-1153, or woodcraft.com.

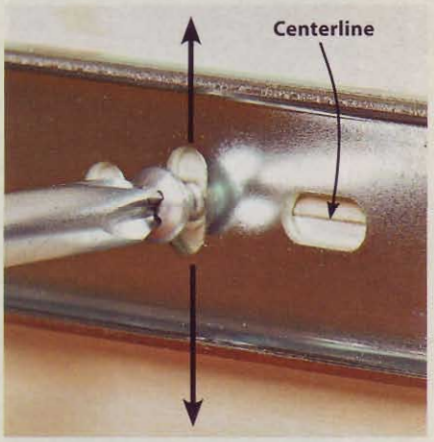
Troubleshoot misaligned drawers

When a drawer front does this...

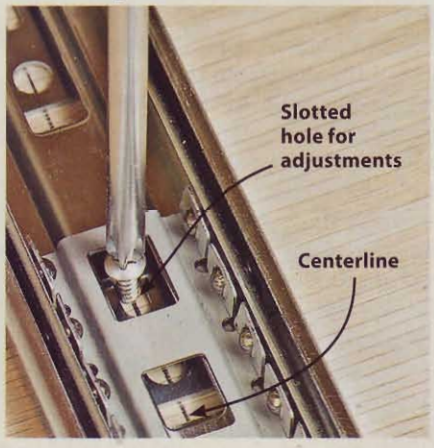




...here's where to fix the problem.



To fix drawers with unequal reveals on the top or bottom, loosen the screws attaching the slide to the drawer box and raise or lower the slide as needed.



When a corner of the drawer front doesn't rest flush with the case, remove the drawer box and shift the case-mounted slide assembly forward or backward.

Better Homes and Gardens®

WOOD® PATTERNS

November 2007 *Issue 180*

Dear Reader: As a service to you, we've included full-size patterns on this insert for irregular shaped and intricate project parts. You can machine all other project parts using the Materials List and the drawings accompanying the project you're building.

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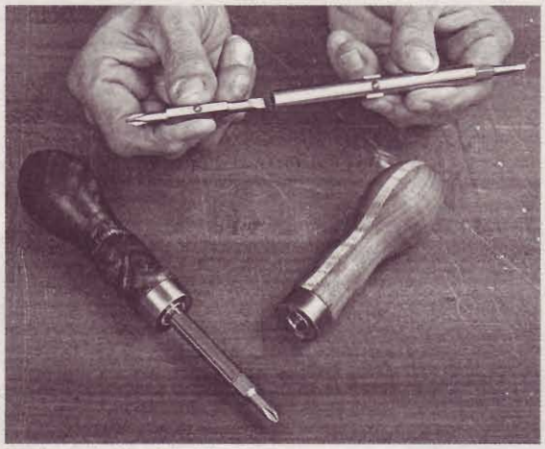
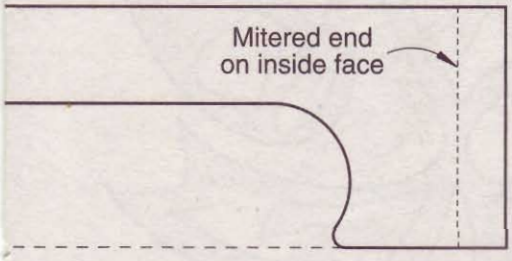
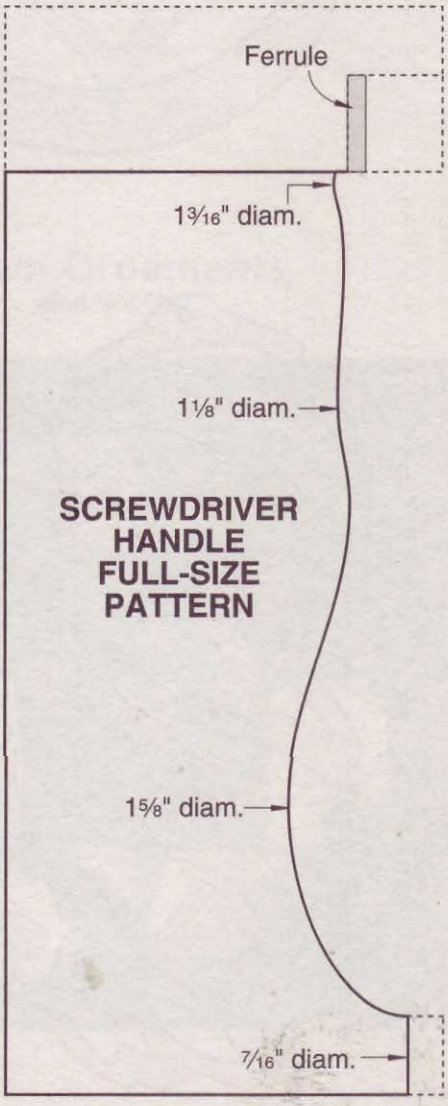
Turned Screwdriver, Page 72







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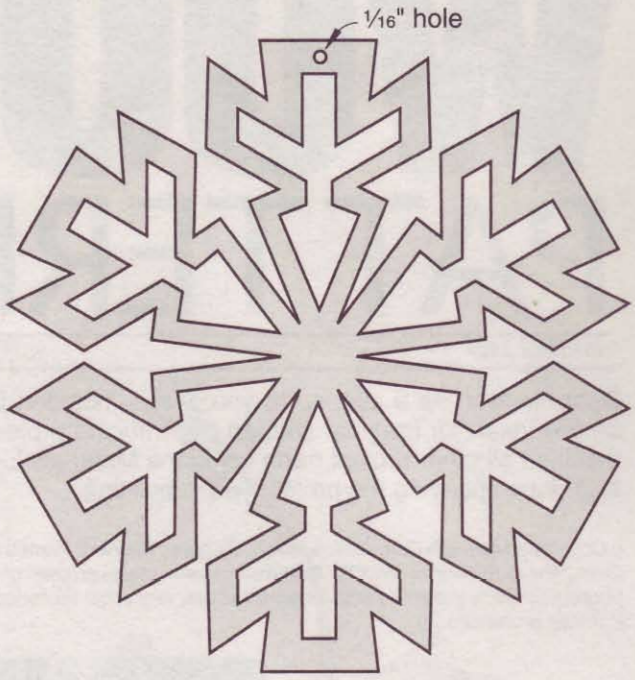
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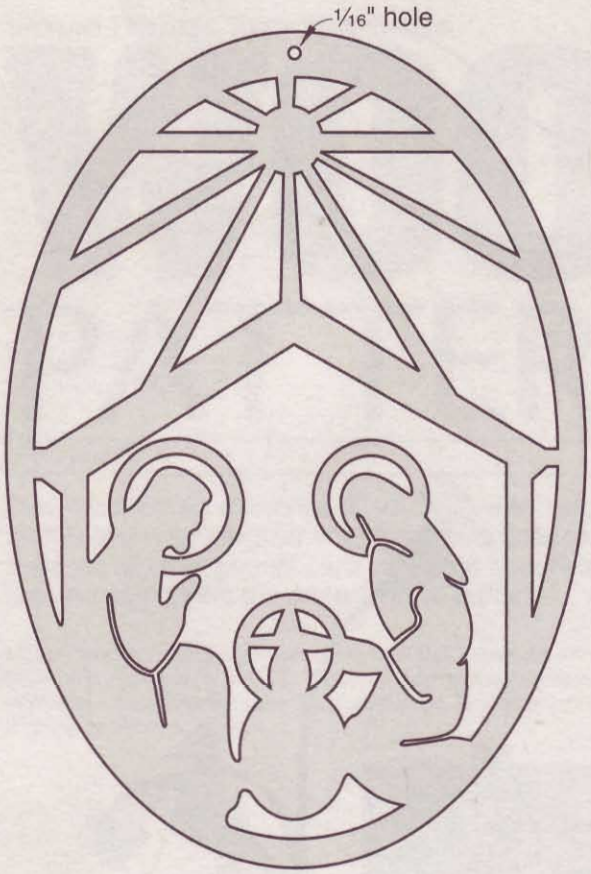
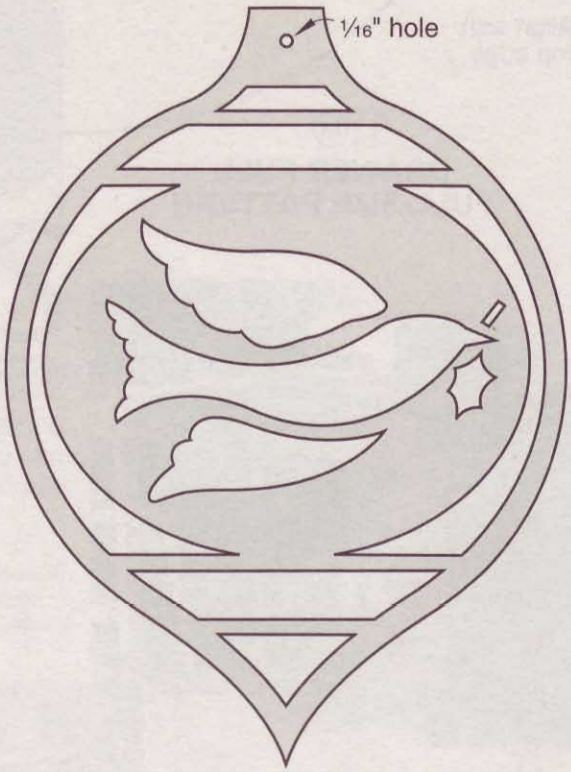
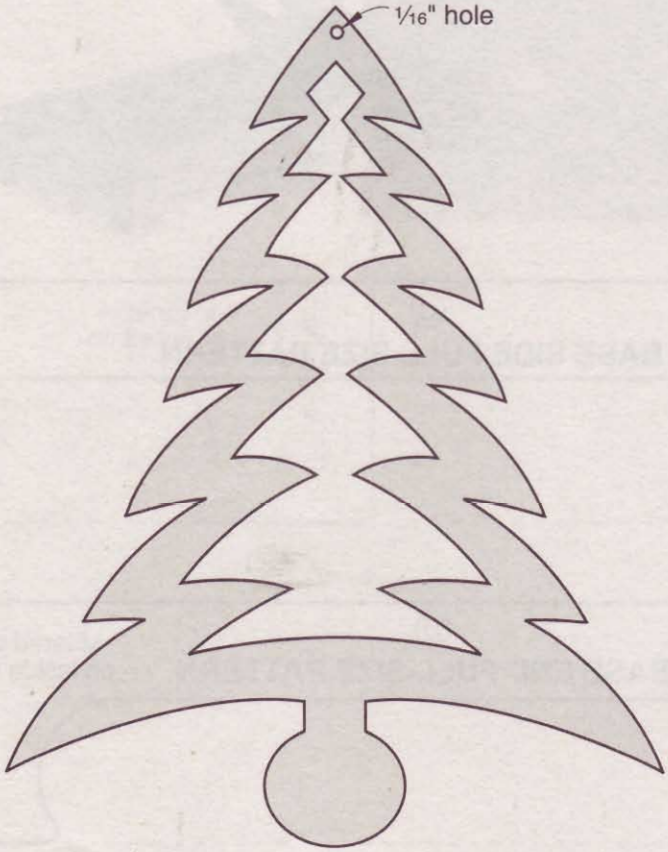
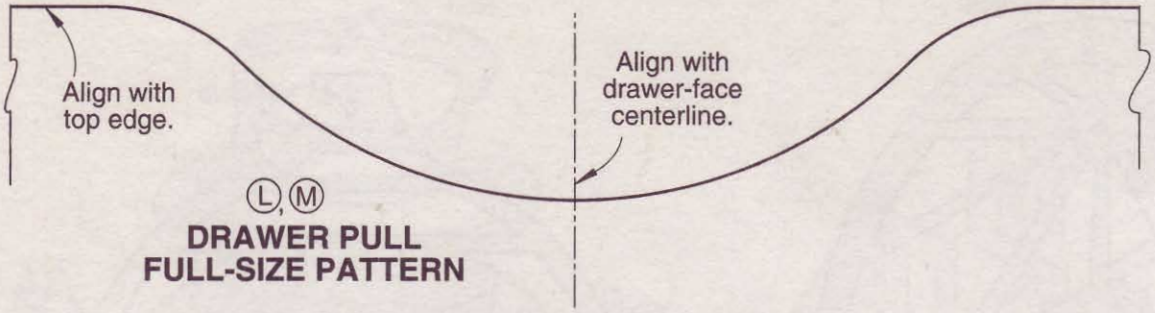






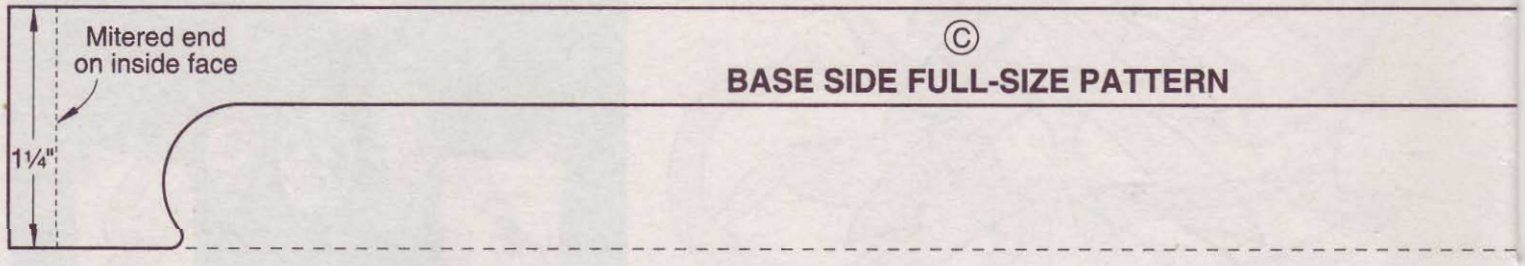
Scrollsawn Ornaments, Page 76

Storage Cart, Page 42



Ⓛ, Ⓜ
DRAWER PULL FULL-SIZE PATTERN

Ikebana Vase, Page 68



Ⓒ
BASE SIDE FULL-SIZE PATTERN

Ⓓ
BASE END FULL-SIZE PATTERN

Three-window Photo Frame

Here's a great last-minute gift you can assemble from hardwood odds and ends. The two-sided design lets you double the number of photos displayed by placing them back-to-back between the panes.

PROJECT HIGHLIGHTS

- Overall dimensions: 17¾" wide × 2¼" deep × 8⅜" high.
- Displays up to six photos.
- Shown here in clear-finished cherry.

Skill Builder

- Learn how to save time by planing one piece of lumber large enough to accommodate all the parts of equal thickness. Also, grouping small parts on a large blank allows you to safely cut them to size.

Make the parts

1 From a ¾×¾×30" blank, cut the end posts (A) to length [**Materials List**, *page 60*]. Rip the remaining blank to ¾×⅝" and cut the middle posts (B) to length. Then attach an extension to your tablesaw miter gauge, and a stop-block to the extension [**Drawing 1**]. Now cut ⅛" dadoes ¼" deep into the front and back faces of the posts [**Drawing 2**].

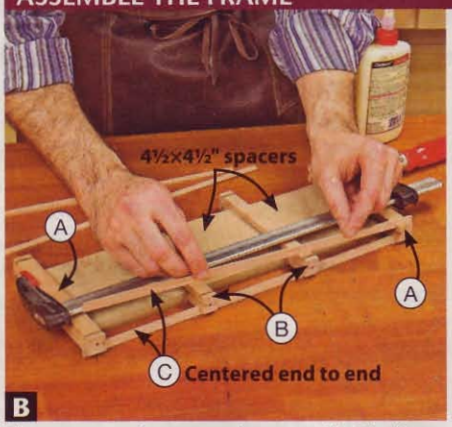
2 Place two photos between two pieces of ⅛" clear acrylic, and adjust a dado blade to cut a groove to fit this thickness. Then cut grooves into the inside edge of each end post (A) and both edges of the middle posts (B) [**Drawing 2**]. Finish-sand the posts.

3 For the bars (C) and cap (D), cut a ⅜×2¼×16½" blank. Then, with a

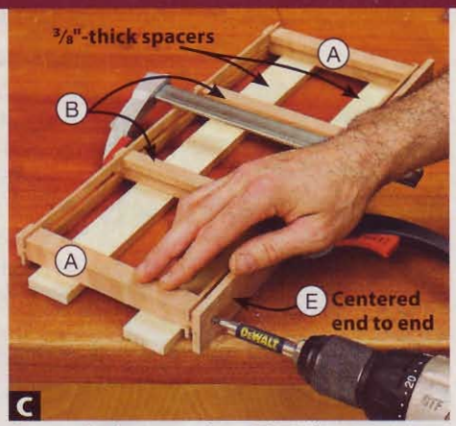
FORM THE CAP EDGE BEVELS

With the cap (D) adhered to a carrier board and the tablesaw blade tilted 27° from vertical, cut the edge bevels.

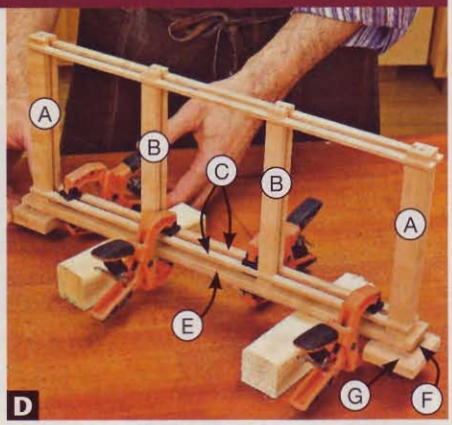
ASSEMBLE THE FRAME



Place spacers between the posts (A, B), align the post ends, and clamp them together. Glue the bars (C) in place, centered.



Center the bottom plate (E) on the posts (A, B). Using the plate holes as guides, drill pilot holes into the posts, and drive the screws.



Glue and clamp the base/feet assembly (F/G) to the plate (E), centered, applying light pressure to the bars (C) close to the posts (A, B).

zero-clearance insert in your tablesaw, rip four bars from the edge of the blank. Finish-sand the bars.

4 Rip the cap (D) to finished width from the remaining ⅜"-thick blank. Lay out the end bevels [**Drawing 3a**], and disc-sand them to shape. Then cut a ¾×1×20" carrier board from scrap, and adhere the cap to it, flush at the edges, with double-faced tape. Cut the edge bevels [**Photo A**]. Finish-sand the cap.

5 For the plates (E) and base (F), cut a ¼×4½×17" blank. Then rip the two plates to width, and rip and crosscut the base to size. Adhere the plates face-to-face with double-faced tape, keeping the ends and edges flush. Lay out the ⅛" hole centers [**Drawing 3**], and drill through both plates on your drill press. Separate the plates, and countersink the holes on the bottom face of the bottom plate for #4 flathead screws. Finish-sand the plates and base.

6 Cut a ½×2¼×6" blank for the feet (G). Then chuck a chamfer bit into your table-mounted router, and chamfer the top edges. Now cut a foot to length from each end of the blank [**Drawing 3**]. Finish-sand the feet.

Assemble the frame

1 Cut three 4½×4½" spacers from scrap. Then glue the bars (C) into the end-post (A) and middle-post (B) dadoes [**Photo B**].

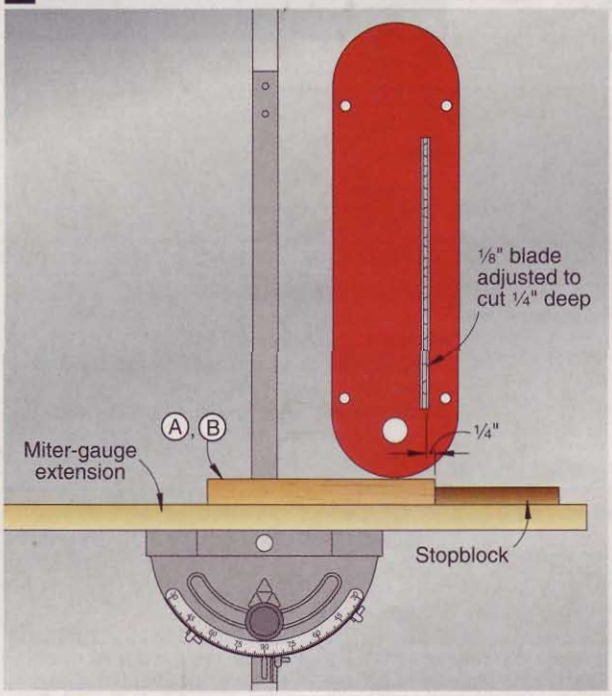
2 Cut two ⅜"-thick spacers, and fasten the bottom plate (E) to the posts (A, B) [**Photo C**].

3 Adhere the top plate (E) to the posts (A, B), centered all around, with double-faced tape. Stand the assembly upright on your drill-press table, and using the holes in the top plate as guides, drill ⅛" holes ½" deep into the posts (A, B). Remove the top plate and the tape. Glue and clamp the cap (D), centered, to the top plate (E).

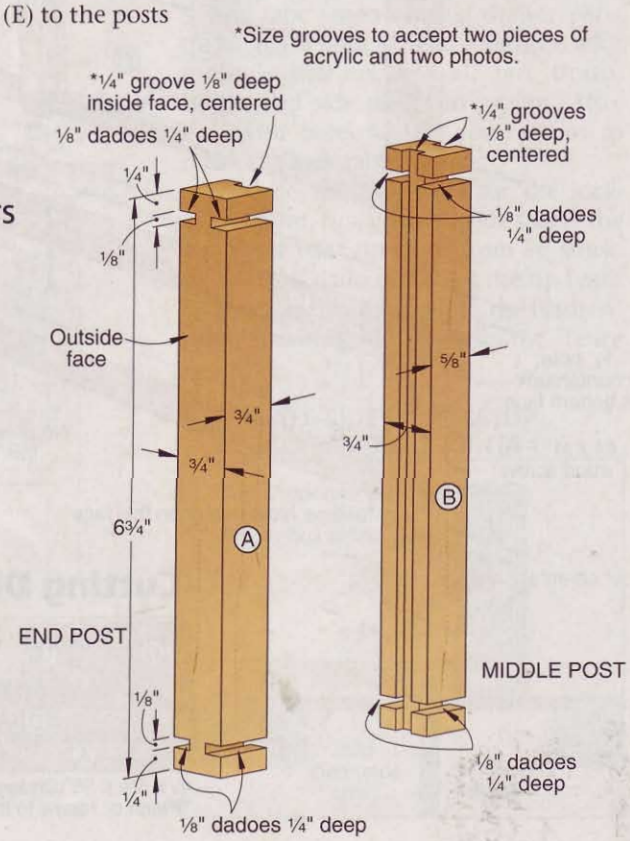
4 Cut four ¾"-long pieces of ⅛" dowel, and glue them into the holes in the tops of the posts (A, B). Drill a ⅛" hole into a piece of ¼"-thick scrap and place it over each dowel. If any dowel protrudes, sand it flush.

5 Glue and clamp the feet (G) to the base (F) [**Drawing 3**]. Then glue and clamp this assembly to the frame assembly (A/B/C/D/E) [**Photo D**].

1 CUTTING THE POST DADOES

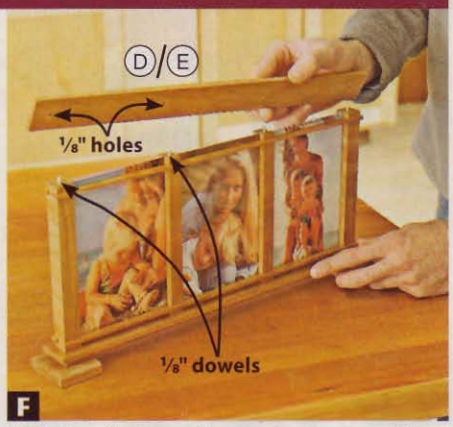


2 POSTS



ADD THE PANES AND PHOTOS

Place two photos back-to-back between two ⅛" acrylic panes. Then slide the entire sandwich into the post (A, B) grooves.



With the photos and panes in place, position the top (D/E), capturing the dowels in the posts (A, B) with the holes in the top plate (E).

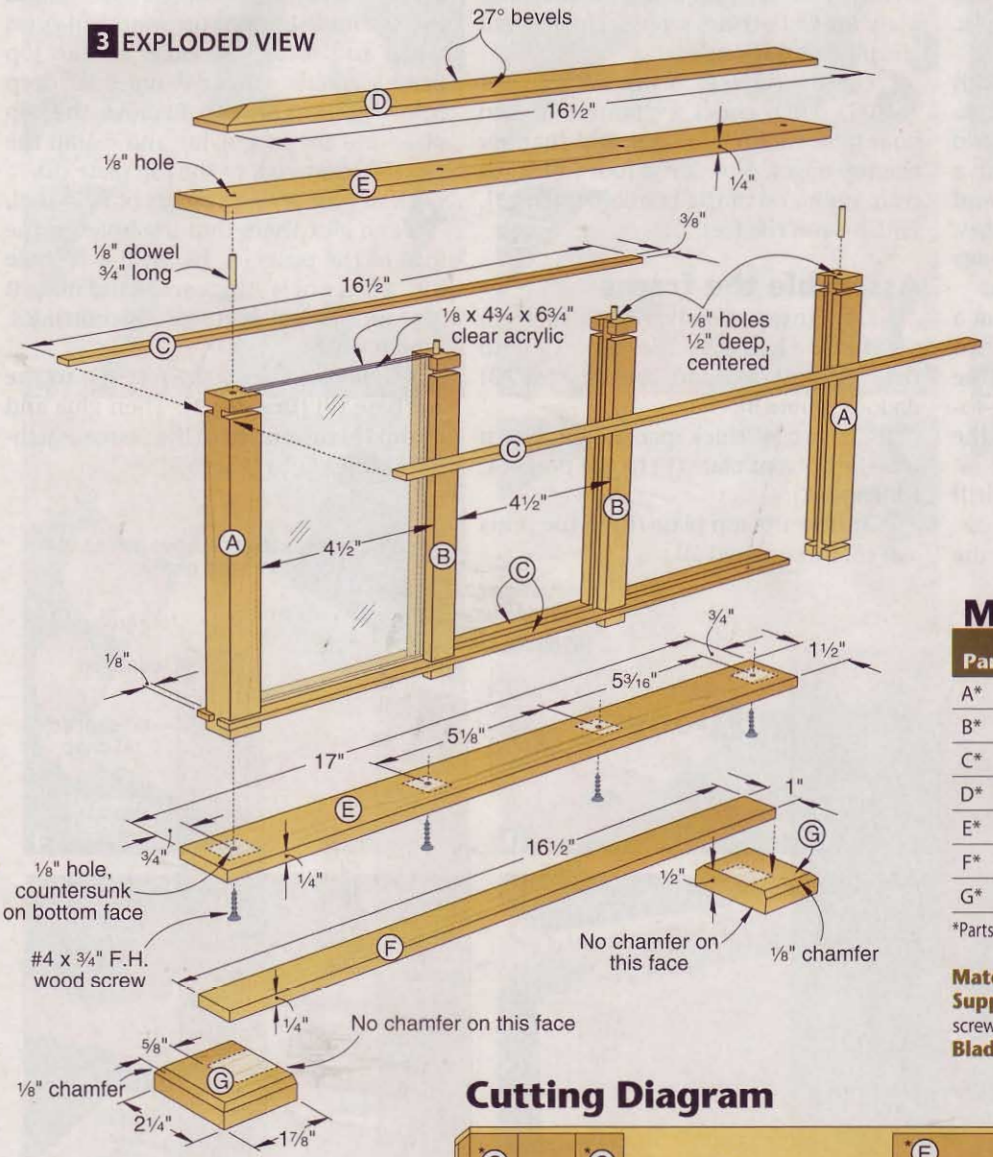
Apply finish, add photos

1 Examine all the parts, and finish-sand where needed. Ease any sharp edges with a sanding block. Apply a clear finish. (We applied three coats of satin lacquer from a spray can.)

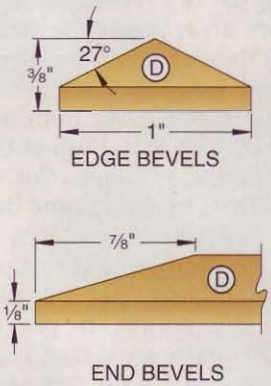
2 Using your finest-tooth tablesaw blade and a zero-clearance insert, cut six ⅛×4¾×6¾" clear acrylic panes. Sand away the saw marks from the top and bottom edges. Then install the panes and photos [**Photos E** and **F**].

Written by **Jan Svec** with **Kevin Boyle**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

3 EXPLODED VIEW



3a CAP BEVELS



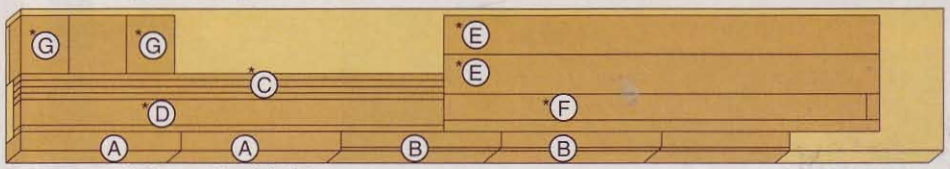
Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A*	end posts	¾"	¾"	6¾"	C	2
B*	middle posts	¾"	⅝"	6¾"	C	2
C*	bars	⅛"	⅜"	16½"	C	4
D*	cap	⅜"	1"	16½"	C	1
E*	plates	¼"	1½"	17"	C	2
F*	base	¼"	1"	16½"	C	1
G*	feet	½"	2¼"	1⅞"	C	2

*Parts initially cut oversize. See the instructions.

Material key: C–cherry.
Supplies: Double-faced tape, #4x¾" flathead wood screws (4), ⅛" dowel, ⅛" clear acrylic.
Blade and bit: Stack dado set, 45° chamfer router bit.

Cutting Diagram



¾ x 5½ x 36" Cherry (1.5 bd. ft.)
*Plane or resaw to the thicknesses listed in the Materials List.

SHOP-TESTED

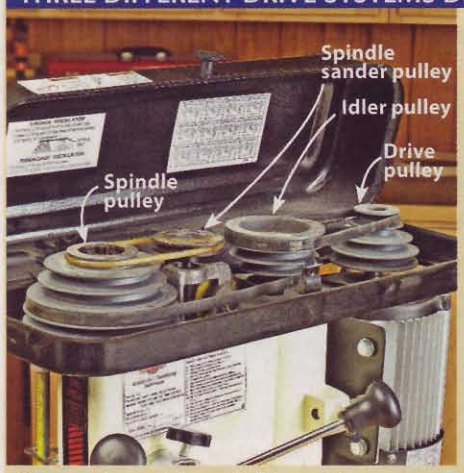
Benchtop Drill Presses

Powering a 2½" Forstner bit into hard maple is a tough challenge for any drill press, but these smaller machines managed the task as well as floor models.

With nearly as much capacity and power as floor-standing units, these brutes get the job done—for half the price.

Thinking about buying a floor-model drill press? Consider this: How often do you bore into the long axis of a workpiece (a lamp base, for example)? Nearly all drilling in woodworking calls for the table to be situated within 4" of the chuck. That means a benchtop drill press not only can handle most of your drilling needs but it also costs about half as much as a floor-standing model. Now, before you dismiss benchtop drills as toy models, read on to find out how manufacturers have narrowed the gap between them and their taller cousins.

THREE DIFFERENT DRIVE SYSTEMS DELIVER DIFFERENT LEVELS OF SLIPPAGE UNDER TORQUE



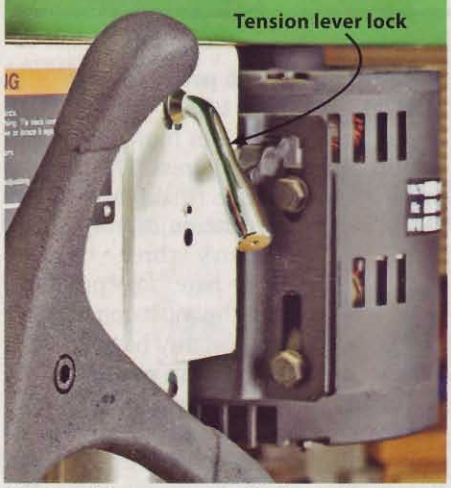
Three-pulley systems (*left*) provide more speed selection and slipped less under torque than stepped two-pulley systems (*center*) in our tests. For continuous variable speed, Ryobi's shiv pulleys (*right*) open and close as you change the speed setting. At top speed, as shown, the drive pulley closes down to run the belt near its outer perimeter, while the spindle pulley opens its widest. For the slowest speed, the drive pulley opens up and the spindle pulley closes down. The variable-speed presses in our test also exhibited little, if any, slippage under torque.

Benchtop drill presses do the job for less money

Despite their small size, benchtop models offer workpiece capacities pretty close to full-size presses. All eight machines we tested offer 12–14" of swing (giving you 6–7" between the chuck center and column), compared with the 17" swing typical of a floor-model drill press. Seven feature at least a 3" stroke (the maximum depth you can plunge a bit). Stationary presses range from a 3½" to 5" stroke. Here again, how often do you drill deeper than a 3" hole?

Although a few have less, most of the tested presses have ½- to ¾-hp motors, equal to those on typical floor models. Most have ample power to bore holes larger than 2½" without forcing the bit to stall, although two machines struggled in that test.

LEVER LOCKS EXCEL AT TENSION



We found lever-operated belt-tensioning systems, such as this one on the Rikon 30-120, made speed changes easier.

Don't let a small package betray the power inside

Curious to see if these machines' horsepower ratings converted to real drilling power, we force-fed each drill press a steady diet of hard maple and white oak under large bits and hole saws, trying to make the bits stall. Using a sharp 2½" Forstner bit and a 2¾" hole saw, we drilled into 2"-thick stock, going easy at first, and then forcing it.

Drill presses with three pulleys, such as the Shop Fox, shown *above left*, handled these tough tests best without the motor stalling or the belts slipping. The two variable-speed units—the Delta DP-350 and Ryobi DP121L—also performed well, as their wide V-belts transferred power from the pulleys to the spindle without slipping. On the other hand, Craftman's 21914 and Delta's DP300L proved easier to stall with their narrow V-belts and smallish pulleys.

For speed changes, you just can't beat the ease of the variable-speed controls on the Delta DP350 and Ryobi drill presses, shown at *right*. We like this feature because it encourages us to actually change speeds—come on, we've all been guilty of not changing speeds for different sizes of bits, right?—by making it so darned easy. With variable-speed presses, the drive and spindle pulleys open and close, as shown at *top right*, changing the chuck speed as you adjust the speed-control handle. We give extra kudos to Ryobi for including a digital display that shows the spindle speed.

Variable-speed control eliminates the nuisance of moving belts to make speed changes, which can be difficult, especially on taller models like the Grizzly G0485 and G7943 and the Rikon 30-120. On multispeed units like these, we prefer the lever-style locks, shown at *bottom left*, on the Grizzly G7943 and Rikon 30-120, which make it easy to adjust motor tension. Spring-loaded rods on others proved more troublesome.

VARIABLE-SPEED CONTROL PROVES USEFUL

Change speeds on the Ryobi (*top*) by swinging the lever; the digital readout shows the speed. Adjust Delta's DP350 (*bottom*) by turning the dial. With no markings, though, you have to guess the speed.

Left to right

Threaded-rod depth stops with two locking nuts proved the most reliable in our test.

Delta's DP350 has a quick-release nut for making large depth adjustments quickly.

Dial stops, like this one on the Rikon, stop the quill-feed handle rotation to control drilling depth.

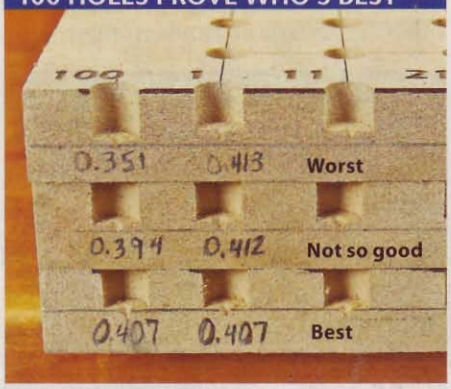
THREE STYLES OF DEPTH STOPS VARY IN DEPENDABILITY

Expect your depth stops to be accurate, repeatable

Every drill press should have a sturdy, reliable stop for drilling multiple holes to the same depth. The Ryobi and Delta DP350 did not. These eight units feature two styles of depth stops (shown *above*): a threaded rod on the left side of the head or a dial stop on the handle shaft. To test the effectiveness of each unit's stop, we drilled 100 holes using a ⅜" Forstner bit, and then measured the depth of the first and last holes with a digital caliper, noting any variation.

Threaded-rod stops with locking nuts performed flawlessly in our tests, with hole depths varying less than .005". The quick-release nut on Delta's DP350, however, rotated about a quarter-turn during the testing, resulting in a difference of .018" from the first hole to the last. We found mixed results with the dial stops, with hole depths on three machines changing from .003" to .008". However, Ryobi's 100th hole was .062" (1/16") deeper than its first.

100 HOLES PROVE WHO'S BEST

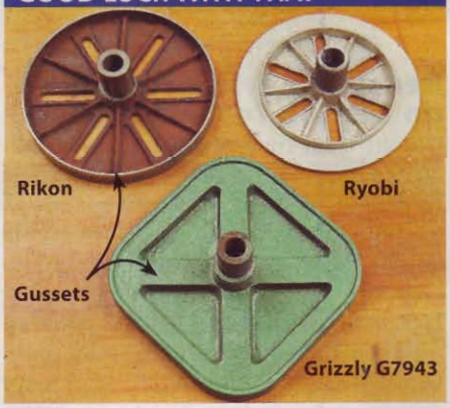


These three test samples show the depth difference between the 100th and first holes for the Ryobi (*top*), Delta DP350 (*center*), and Grizzly G0485 (*bottom*).

Don't look for the ideal drill-press table here

With all the improvements made to drill presses recently, manufacturers continue to overlook tables. All tested models have cast-iron tables—better suited for metalworking—with rack-and-pinion crank lifts. Large, deep gussets and extended rims underneath make it difficult to clamp workpieces to the tables. The best of the bunch is on the Ryobi with a 2"-wide perimeter underneath, as shown *above*. We could clamp a fence or jigs to this table easier than the others.

CLAMPING TO TABLES: GOOD LUCK WITH THAT



The undersides of these three tables show how difficult it can be to find good clamping area, except on the Ryobi.

Other features to influence your buying decision

■ Spindle runout was a pesky, but not major problem.

Runout—the wobble of the spindle as it spins—varied from .001" to .009" with the eight machines when measured with a precision steel rod locked in the chucks. (Industry standards vary, but several manufacturers say they demand .006" or less of spindle runout.) But when we drilled holes with each machine using a 2" Forstner bit, we found almost no difference in diameter, even on the machines with the greatest runout. We did find that the wobble in the worst machines made it slightly tougher to place the point of a spinning bit precisely onto a crosshair.

■ Lasers prove helpful.

The Craftsman, Delta DP300L, and Ryobi have bright-red crosshair lasers to aid in aligning your drill bit. Once calibrated, they proved dead-on at marking the centerpoint of any bit. Ryobi gets praise for easy adjustment and for being wired to the machine. (The others are battery-operated.) Delta's laser mounts to the column just below the head, so it provides the best angle, especially for large bits that can block the others. Craftsman's laser location led us to accidentally knock it out of adjustment several times during testing.

■ Handle leverage proves critical for larger bits.

A long handle provides more force than a short one on a drill press. The handles on two tested models (Rikon and Delta's DP300L) proved uncomfortably short. One of Craftsman's three handles, shown *on the next page, top*, produced good leverage and the most comfortable and ergonomic feel of any handle.

■ Mortising with these presses requires great patience.

Sure, you can use mortising attachments on most of these machines. (All but Ryobi offer them as accessories.) But between removing equipment (lasers, chuck guards, etc.) to make room for the

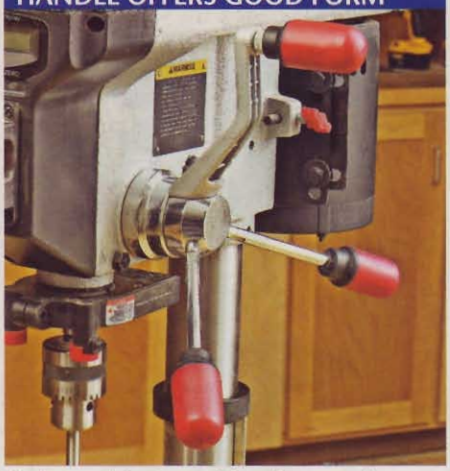
attachment, fussing with adding and aligning a fence, and adjusting the depth stops, it's hardly worth the effort. Instead, we believe it's worth the money to invest in a benchtop mortiser.

■ **Come on, baby, light my work.** Incandescent lights mounted inside the head behind the chuck produce a lot of light, but large bits create a shadow on the centerpoint you need to see. We prefer incandescent lights mounted on flexible necks (on both Delta models) so you can direct light exactly where you need it. Craftsman's flexible LED light proved too dim to offer much help.

■ **It's a handy sander, too.** Shop Fox's W1668 converts to an oscillating spindle sander, shown at *far right*, with a simple belt change. Insert one of the three sanding drums into the chuck, and then swing the table so the drum can drop through the 2¼" hole.

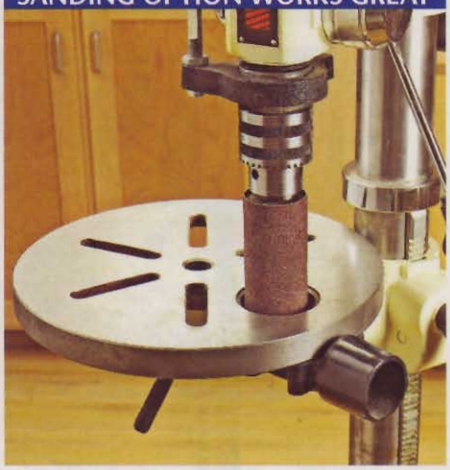
■ **Switches do make a difference.** You only need a power switch to turn a machine on and off. But it matters most when you need it in an emergency. We like front-mounted paddle-style switches because they're easiest to turn off, especially if you can't take your eyes off your work. Shop Fox's side-mounted paddle switch proved more difficult to find quickly.

HANDLE OFFERS GOOD FORM



Craftsman's horizontal handle proved effective and comfortable, even with large bits that require more force.

SANDING OPTION WORKS GREAT



When using Shop Fox's drill press as an oscillating spindle sander, attach your shop vacuum hose to the 2¼" dust port.

Meet the benchtop drill team

Craftsman 21914, $200

800-383-4814, craftsman.com

We like the unique quill-feed handle and digital depth scale, but the drive belt on this light-duty machine slipped easily while drilling with large bits. With high spindle runout, we had difficulty placing bits onto a pinpoint crosshair. The LED worklight is a good idea, but too dim. You need to remove—and later recalibrate—the laser from the quill to install a mortising attachment.

Delta DP300L, $200

800-223-7278, deltaportercable.com

Like the Craftsman, this machine is light-duty, with the belt slipping easily when using large bits and hole saws. Its handles are small and toyish, it has an inch less of quill stroke than the other models, and it has the smallest table. The DP300L's laser proved accurate and helpful, and we liked the flexible worklight. Its dial depth stop performed well in testing.

Delta DP350, $240

800-223-7278, deltaportercable.com

We love the versatility of this unit's variable speed, although the addition of speed markings on the scale would make this good drill press even better. The depth stop's quick-release nut makes for fast adjustments but slipped more than we like in our 100-hole test. Large quill-feed handles provide good leverage, and the flexible incandescent worklight puts bright light where needed.

Grizzly G0485, $190

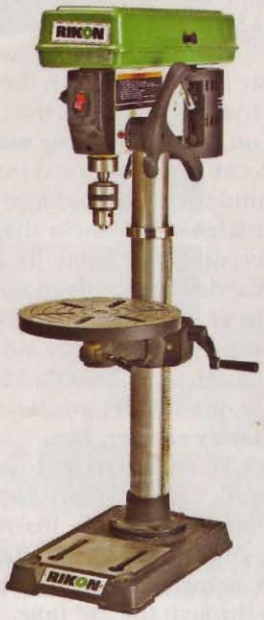
800-523-4777, grizzly.com

This no-frills drill press proved itself capable and accurate beyond our expectations, given its low price. It had the least amount of quill and spindle runout, and its depth stop produced 100 holes of identical depth—the best in the test. With a bottom-end speed of 230 rpm and top speed of 3,270 rpm (16 total), the G0485 provides a wider speed range than most, for large and small bits. It's the only unit to include a clear-plastic safety guard around the chuck.

Grizzly G7943, $225

800-523-4777, grizzly.com

Capacity, capacity, capacity: The G7943's 14" swing, ¾-hp motor, and ⅝" chuck were all tops among the eight tested machines. It also has a generous table, and weighed the most at 140 pounds. With a test-best slow speed of 140 rpm, it has the low-end torque to handle large boring jobs with ease, and its threaded-rod depth stop proved reliable. Our lone knock: With the most spindle runout in the test, we had difficulty placing bits onto a pinpoint crosshair.



Rikon 30-120, $250

877-884-5167, rikontools.com

Rikon's 42"-tall machine provides the largest vertical capacities in the test. But it also required a step-stool to change speeds. The 30-120's low-end 220 rpm proves a plus for large bits, and its 3,600 rpm top speed was highest among the eight machines. With the largest table center hole (1⅛"), it also has replaceable inserts. The handles are short and awkward to use, though, and we bumped our hand regularly on the motor tensioning lever when lowering the quill.

Benchtop Drill Presses under $300: More Than the "Boring" Facts

		DIMENSIONS, INCHES				DRIVE SYSTEM		CHUCK, SPINDLE, AND QUILL						TABLE		CONTROLS		FEATURES	PERFORMANCE GRADES (7)							
MANUFACTURER	MODEL	SWING (1)	OVERALL, HxWxD	BASE FOOTPRINT, WxD	NUMBER OF SPEEDS (2)	MINIMUM/MAXIMUM SPEEDS, RPM	CHUCK CAPACITY, INCHES	MAX. HEIGHT, CHUCK TO TABLE, INCHES	MAX. HEIGHT, CHUCK TO BASE, INCHES	STROKE, INCHES	DEPTH-STOP STYLE (3)	QUILL-LOCK STYLE (4)	SIZE, INCHES	TILT RANGE, LEFT/RIGHT, DEGREES	SWITCH STYLE (5)	SWITCH LOCKOUT: YES, NO	WORK LIGHT (6)	LASER: YES, NO	OBSERVED POWER AND TORQUE (8)	SPINDLE ACCURACY	DEPTH-STOP DEPENDABILITY	EASE OF CHANGING SPEEDS	HANDLE LEVERAGE	EASE OF ANGLED DRILLING	EASE OF CLAMPING TO TABLE	WORK-LIGHT EFFECTIVENESS	MANUAL CLARITY
CRAFTSMAN	21914	12	37½×14×22	8½×11½	5	500/3,000	½	15⅞	20	3¼	D	D	10×10	45/45	P	Y	LED	Y	C	B-	A-	A-	A	A	A-	B	A
DELTA	DP300L	12	34×22×22	10×16	5	620/3,100	½	13⅞	18¾	2⅜	D	D	8¾×8¾	45/45	T	Y	IF	Y	C	A	A	A-	C-	A	A-	A	A-
DELTA	DP350	12	36½×16×23	10×16	VS	500/3,100	½	12⅞	18	3⅛	Q	R	9½×9½	45/45	B	N	IF	N	A	A	B	A	A-	A	B	A	B
GRIZZLY	G0485	13	38½×14×24	10×17	16	230/3,270	⅝	12⅞	20	3⅛	T	N	11½ dia.	90/90	P	Y	IH	N	A	A	A	A-	A-	B	B	B+	A-
GRIZZLY	G7943	14	38½×14×24	10½×17½	12	140/3,050	⅝	12⅝	20	3¼	T	N	11⅜×11⅜	90/90	P	Y	IH	N	A	B-	A	A	A-	A	B	B+	A
RIKON	30-120	13	42×15×24	11×18	16	220/3,600	⅝	16⅝	25	3¼	D	D	11⅞ dia.	45/45	T	Y	N/A	N	A	A	A-	A	C+	B	B	N/A	C
RYOBI	DP121L	12	35½×13×22	10½×16½	VS	500/3,000	½	12½	18	3⅛	D	L	11 dia.	45/45	P	Y	IH	Y	A	A-	C	A	A	A-	A	B+	A
SHOP FOX	W1668	13	38×15×24	11×17½	12	250/3,050	⅝	13½	21	3¼	T	N	12½ dia.	45/45	P	Y	N/A	N	A	A-	A	B	A	B	B	N/A	A

Ryobi DP121L, $170

800-525-2579, ryobitools.com

The DP121L sports big-machine features (variable speed, digital speed display, and a reliable laser crosshair that never needs batteries) at a benchtop drill-press price. It has the best table for clamping with an adjustable tilting scale, and the price includes a work-holding vise. Only one thing stood between the DP121L and our Top Tool award: Its depth stop slipped the most in our testing. If you don't do much multiple-hole drilling, though, get this machine.

Shop Fox W1668, $260

800-840-8420, shopfox.biz

The W1668 is an average-performing drill press that doubles as an oscillating spindle sander and comes with three drums 1–2" in diameter. That may make it worth the premium price to you. It has a good speed range, and its depth stop proved reliable in our testing. The sanding relief hole and dust port make clamping workpieces to the right side of the table difficult. The left-side-mounted power switch is more difficult to reach than front-mounted ones.

Most perform well; Here's what we'd buy

There was no runaway choice for Top Tool because each machine had its quirks. Nevertheless, we feel confident in recommending both the Grizzly G0485 and Delta DP350 as Top Tools. The Grizzly is a solid, no-frills machine that delivers highly accurate results—its depth stop never budged while drilling 100 holes.

We like the Delta DP350 for its variable-speed control, surprisingly high torque, flexible work light, and large knobs on long handle shafts. We'd be willing to live with a little slippage of its depth stop to have the variable speed.

The unreliable depth stop on the Ryobi DP121L kept it from contending for Top Tool. But if that's a non-issue for you, this is a powerful variable-speed drill press, nicely equipped, for $70 less than the DP350. So the DP121L earns our Top Value award.

Written by **Bob Hunter** with **Jeff Hall**

ACCESSORIES (9)					
STANDARD	OPTIONAL	WEIGHT, POUNDS	CORD LENGTH, FEET	WARRANTY, YEARS	SELLING PRICE (10)
F,L	M,S,V	93.7	6.0	1	$200
L,T	M,P,S,V	78.5	6.0	2	$200
L	M,P,S,T,V	103.5	6.0	2	$240
G,K,L	G,M,S,V	99.6	5.0	1	$190
L	G,M,S,V	140.5	8.0	1	$225
K	G,M,V	121.0	6.0	2	$250
L,V		95.9	6.5	2	$170
S	M,V	119.7	9.5	2	$260

Notes:

1. Largest diameter workpiece you can drill to the center. (Double the distance from the chuck center to the column edge.
2. (VS) Variable speed
3. (D) Dial depth stop
   (Q) Threaded rod with quick-release nut
   (T) Threaded rod with locking nuts
4. (D) Dial stop with nut lock
   (L) Dial stop with lever lock
   (N) Threaded rod with nut lock
   (R) Threaded rod with lever lock
5. (B) Button
   (P) Paddle
   (T) Toggle
6. (IF) Incandescent bulb on flexible arm
   (IH) Incandescent bulb in head
   (LED) Light-emitting diode on flexible arm
   (N/A) No light included
7. A Excellent
   B Good
   C Fair
8. Boring with 2½" Forstner bit and 2¾" hole saw in hard maple and white oak.
9. (F) Fence
   (G) Chuck guard
   (K) Chuck key holder
   (L) Light
   (M) Mortising attachment
   (P) Switch padlock
   (S) Sanding drums
   (T) Tool tray
   (V) Drill vise
10. Prices current at time of article production and do not include shipping, where applicable.

Ikebana Vase

Ikebana, the Japanese art of arranging flowers, differs from Western practice by using asymmetrical form and including empty space as part of the composition. Any plant material—branches, leaves, grasses, moss, and fruit—may be used. Withered leaves, seedpods, and buds are valued as highly as flowers in full bloom.

The vase is considered an important part of the whole. With this simple project, you can create a pebbled stage for a few carefully chosen branches and blossoms.

PROJECT HIGHLIGHTS

- Overall dimensions: 5½" wide × 10½" long × 1¾" high.
- Shown here in cherry.

Skill Builder

- Save time and ensure accurate miters on layered parts by cutting the parts oversize, gluing them together, and mitering the assembled parts.

1 From ¼"-thick stock, cut tray-side (A) blanks and base-side (C) blanks to finished width [**Materials List**] and 11" long. Then cut tray-end (B) blanks and base-end (D) blanks to finished width and 6" long. Finish-sand the blanks.

2 Cut rabbets along the bottom inside edges of the tray-side (A) and tray-end (B) blanks [**Drawing 1**]. Then, to make the part of the tray visible through the base (C, D) cutouts "disappear," color the bottom portion of each side and end [**Photo A**].

3 Adhere the base-side (C) and base-end (D) blanks together back-to-back and edges flush with double-faced tape. Photocopy the **Base Patterns** on the *WOOD Patterns*® insert, and cut them out. Adhere the patterns to the appropriate paired blanks with spray adhesive, centering the patterns end-to-end. Then mark the finished lengths and the overlap of the tray parts A and B on the base parts C and D [**Drawing 2**]. Now bandsaw and sand the cutouts, and remove the patterns. To get top-notch results when sanding the cutouts, see *page 26*.

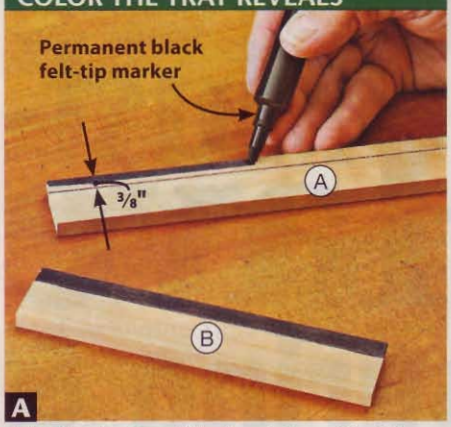
4 Separate the parts. Then glue and clamp the tray sides (A) to the base sides (C), and the tray ends (B) to the base ends (D), aligning the tray part bottom edges with the overlap lines on the ends of the base parts [**Drawing 1**]. Use the glue sparingly to avoid squeeze-out.

5 Miter the side-blank (A/C) and end-blank (B/D) assemblies to finished length, cutting to the lines marked on the base parts (C, D). Then glue and clamp the frame (A/B/C/D), checking for square.

6 Check the dimensions of the tray (A/B) rabbeted opening, and cut the bottom (E) to size. Chuck a 2" Forstner bit into your drill press, and drill a hole for the flanged flower arranger [**Drawing 1**]. Finish-sand the bottom, and glue and clamp it into the tray rabbets.

7 From ¼"-thick stock, cut a 1×12" blank for the short dividers (F) and long divider (G). Check the dimensions from the tray sides and ends (A, B) to the edge of the hole in the bottom (E), and cut the dividers to length. Bandsaw a notch into each part [**Drawing 1**]. Finish-sand the dividers, and glue and clamp them in place [**Photo B**].

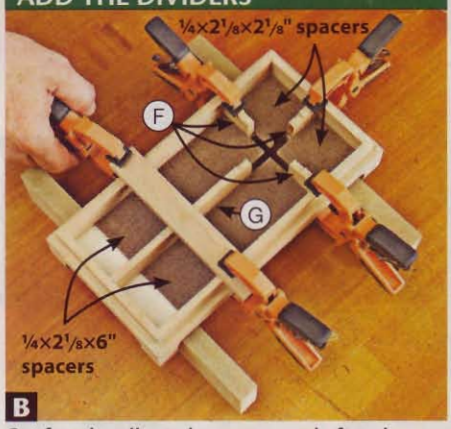
COLOR THE TRAY REVEALS



A

Color the bottom 3/8" of each tray-side (A) blank and tray-end (B) blank with permanent black felt-tip marker.

ADD THE DIVIDERS



B

Cut four hardboard spacers, and after dry-fitting, glue and clamp the short dividers (F) and long divider (G) in place.

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A*	tray sides	1/4"	1 1/4"	10"	C	2
B*	tray ends	1/4"	1 1/4"	5"	C	2
C*	base sides	1/4"	1 1/4"	10 1/2"	C	2
D*	base ends	1/4"	1 1/4"	5 1/2"	C	2
E	bottom	1/4"	4 3/4"	9 3/4"	BP	1
F*	short dividers	1/4"	1"	1 1/4"	C	3
G*	long divider	1/4"	1"	6 1/4"	C	1

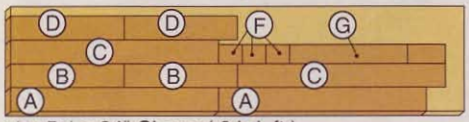
*Parts initially cut oversize. See the instructions.

Materials key: C–cherry, BP–birch plywood.
Supplies: Double-faced tape, spray adhesive, permanent black felt-tip marker.
Blade and bit: Stack dado set, 2" Forstner bit.

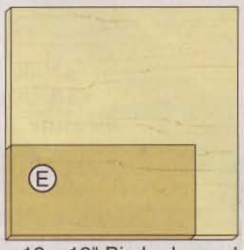
Source

Flower arranger: Black pewter flanged flower arranger no. 158914, $7.95 ea. Call Packard Woodworks, 800-683-8876, or go to packardwoodworks.com.

Cutting Diagram

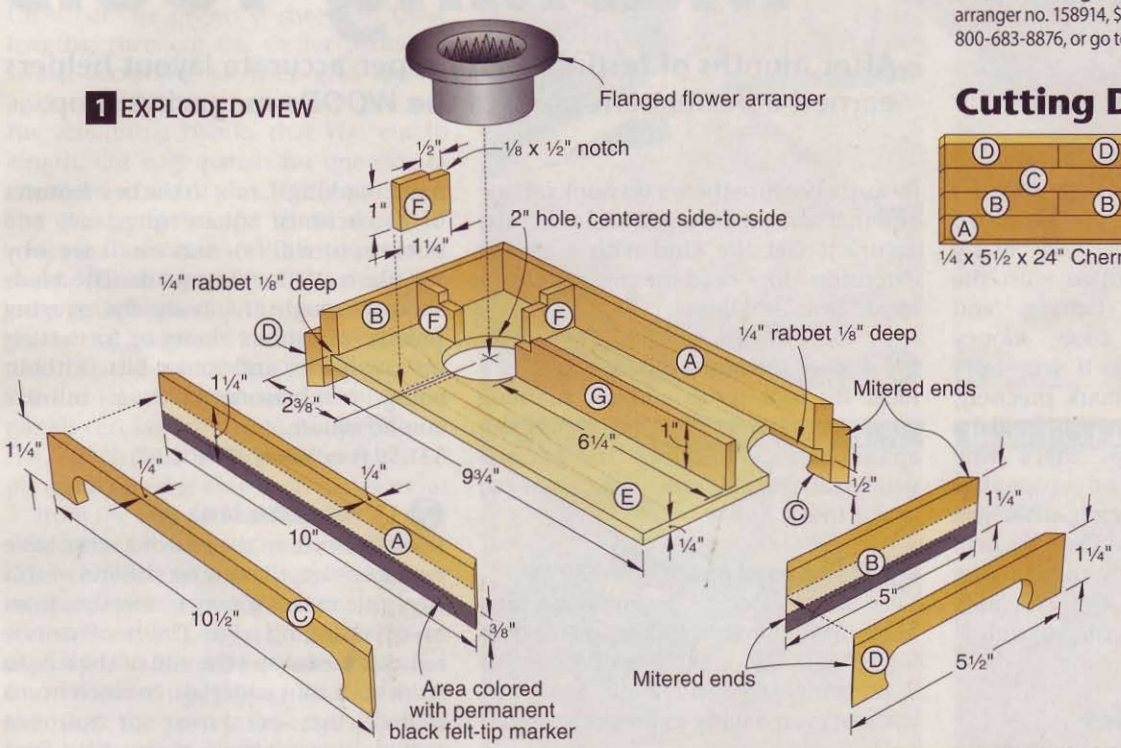


1/4 x 5 1/2 x 24" Cherry (.3 bd. ft.)

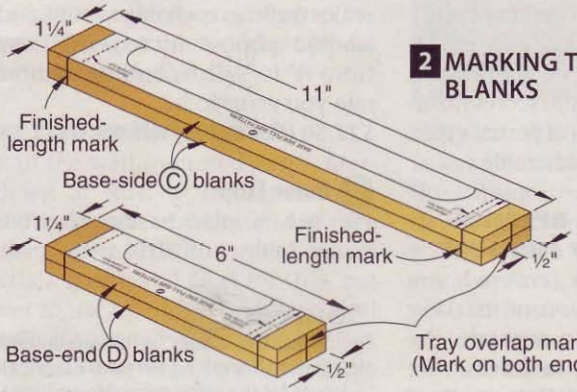


1/4 x 12 x 12" Birch plywood

1 EXPLODED VIEW



2 MARKING THE BASE BLANKS



Learn more about ikebana

For information about the basic styles of ikebana and how to create them, as well as a plan for an additional ikebana vases go to woodmagazine.com/ikebana.

8 Examine all the parts, and finish-sand where needed. Do not sand the black-colored areas. Apply a clear finish. (We applied three coats of satin polyurethane from a spray can, sanding between coats with 220-grit sandpaper.)

9 Insert the flower arranger, cradling the flange in the divider (F, G) notches, and fill the tray with pebbles. (We purchased a bag of polished pebbles from a crafts supply store, and picked out the black ones.) Now fill the arranger with water, and artfully position a handful of long-stemmed blossoms.

Written by **Jan Svec** with **Chuck Hedlund**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Must-Have Measuring & Marking Tools

After months of testing, these super-accurate layout helpers earned a permanent place in the *WOOD*® magazine shop.

Your shop may be filled with the finest cutting and shaping tools money can buy, but if you don't measure and mark precisely, your project parts will fit like a cheap suit. Perhaps that's why woodworking catalogs offer page after page of products promising to make you a more accurate woodworker. To help you sort it all out, here are the marking and measuring tools we find essential, plus some that are just darned useful.

First, make sure you have the basics

Before you fill your drawers with fancy gadgets, you need a handful of high-quality marking and measuring devices. The five items shown *above* may not be flashy, but you'll reach for them nearly every day.

1 6" and 12" steel rules

Look for a matte or satin finish with etched markings (rather than stamped) for accuracy and readability. Increments should go down to at least 1/32". Buy one with a combination-square head and you'll multiply its value at least threefold by adding the ability to check and mark perfect 90° and 45° angles.

2 Folding rule

For longer dimensions, a 6' folding wooden rule provides more reliable accuracy than a retractable steel tape measure because there's no hook on one end that can get damaged and affect the accuracy. Get the kind with a sliding extension for dead-on measurement inside cases and boxes.

3 4" or 6" machinist square

Ideal for tool setup and for marking crosscuts precisely, it slips easily into an apron pocket. Good thing, too, because you'll reach for this more often than you might think.

4 Sliding bevel gauge

This simple device performs for any angle what a combination square does for 90° and 45°, making transferring or duplicating that odd angle foolproof, without even having to know the angle.

5 Mechanical pencil or marking knife

Measuring to a gnat's backside means little if your old carpenter's pencil makes a wide swath. A marking knife scores razor-thin lines, and a mechanical pencil's thin mark is consistent and predictable.

Now add to your arsenal with these handy helpers

Once you have the basics covered, you can expand your collection of marking and measuring tools. To separate the gimmicks from the "gotta haves," we bought several hundred dollars worth of these tempting tools and tried them out. Here are the keepers.

6 4" double square

Take the best features of a combination square (easy adjustability and measurement markings), mix in the best features of a machinist square (precision and pocket portability), and you'll see why we like a 4" double square. The blade slides through the body for gauging reveals on cabinet doors or for setting up saw blades and router bits, without being cumbersome like a full-size combo square.

$31.50 (Lee Valley, 24N08.01)

7 12" adjustable hook rule

Like the hook on the end of a retractable tape measure, the one on the end of this steel rule makes it easy to measure from an overhanging edge. The hook can be repositioned along the end of the rule to work with thin materials; to reach over a routed edge, as shown; or you can remove it completely if you like. Four scales (one on each edge, front and back) let you choose incremental markings from ⅛" to 1/64", depending on how accurate you want to be.

$22.50 (Lee Valley, 24N08.11)

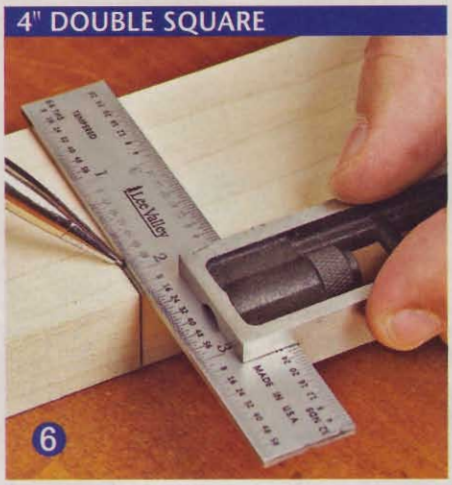
8 Ruler Stop

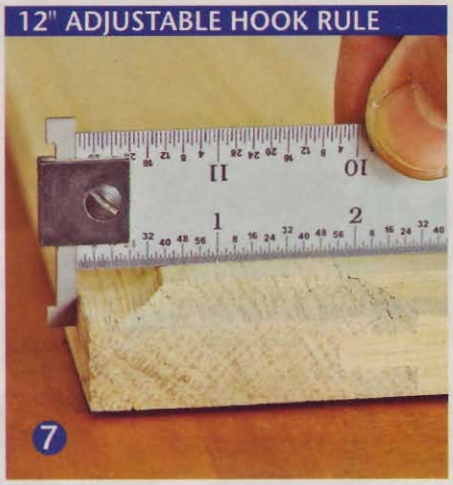
We use stopblocks on the tablesaw, router table, and drill press practically

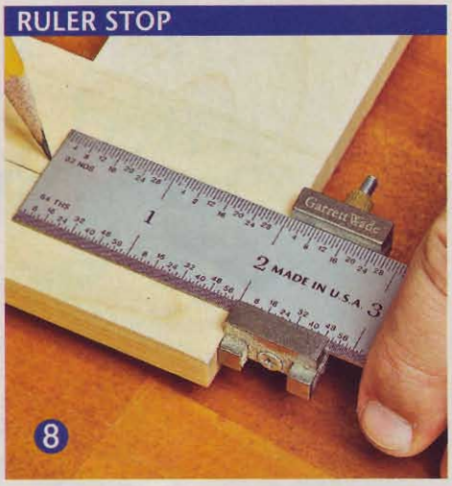
Sources

You'll find the "basics" at many retailers and in catalogs, including the ones listed below. Sources for the other products are listed at the end of each description.

Garrett Wade, 800-221-2942, garrettwade.com
Lee Valley, 800-871-8158, leevalley.com
McFeely's, 800-443-7937, mcfeelys.com
MLCS, 800-533-9298, mlcswoodworking.com
Rockler, 800-279-4441, rockler.com
Woodcraft, 800-225-1153, woodcraft.com







every day in the *WOOD*® magazine shop to ensure multiple matching cuts or evenly spaced holes. Why wouldn't you want that same reliable repeatability when marking and measuring? The dovetail slot in this handy add-on grips virtually any steel rule up to 1 3/16" wide. We put a Ruler Stop at each end of a 12" rule and flipped it end for end as we marked a series of cabinet door handles 2" up from the bottom (flip!) and 1" in from the edge.

Garrett Wade, $19.95 (16R01.10)

9 Veritas Miter Hook

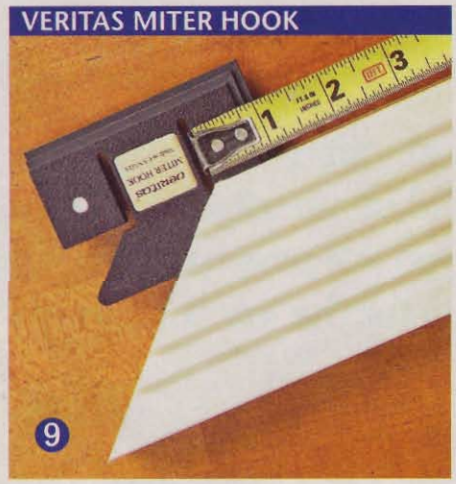
The toughest measurement to make accurately has to be the short length (or *heel*) of a mitered workpiece, such as the inside dimensions of a picture frame or window casing. Veritas' Miter Hook makes this previously formidable task foolproof by giving you a solid place to hook your retractable steel tape measure. Steel pins bite into the end grain, and rare-earth magnets keep the tape from coming unhooked from the hook. As a bonus, stepped edges around the Miter Hook act as 1/8" and 1/4" reveal gauges for perfect placement of moldings.

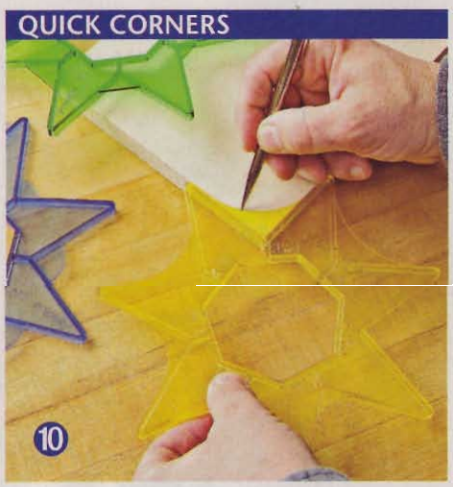
$12.95 (Lee Valley, 05N37.01)

10 Quick Corners

We've all done it: To mark a radius on the corner of a workpiece, you pull out a coin (or soda can, or glue bottle, or roll of masking tape, or...) and trace around it. It's tough, though, to locate that temporary template perfectly on the corner. Quick Corners transparent templates self-index to any square corner for marking precise radii every time. We found the yellow template, for marking convex curves from 1/2" to 2" in 1/4" increments, the most useful. The set also includes templates for concave radii, chamfered corners, and convex radii up to 6".

$20 (McFeely's, Rockler, Woodcraft)

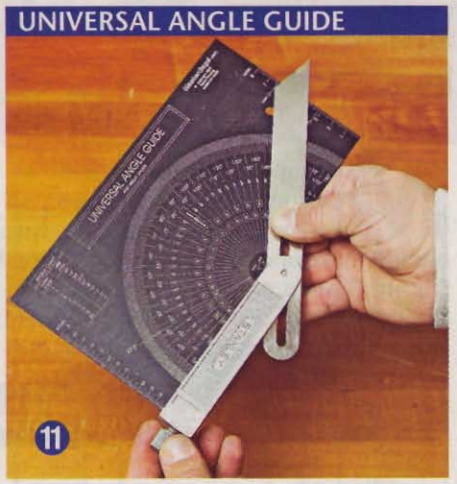




11 Universal Angle Guide

When you need to mark a known angle (and not merely copy or match one), you can't beat the precision of this multi-function tool. Although spendy, its super-fine laser-etched markings provide a dead-on reference for any angle from 0° to 180° in 1/2° increments. Use it to set your miter gauge or sliding bevel gauge, as shown at *right*. Either end of the Universal Angle Guide also can be used to set router bit and saw blade height, but we found the fine markings difficult to read for this purpose.

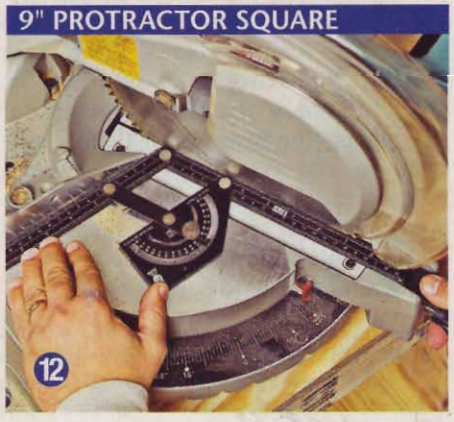
MasterGage, $66 (888-893-8300, mastergage.com)



12 9" protractor square

This oversize bevel gauge picks up where your pocket-size model leaves off. For transferring angles from an odd-shaped piece to the mitersaw (as shown) or to your tablesaw miter gauge, the long blades of a protractor square provide plenty of bearing surface to ensure precise setup. This device does have a degree scale that you could use to set specific angles, but the small, closely spaced markings are difficult to read.

$20 (Lee Valley, Woodcraft)



4-in-1 Turned Handle Screwdriver

With a double-ended bit in each end of a reversible shaft, you'll always have the right tip for the job at hand.

Making a screwdriver with a custom handle is a project so easy and useful that every turner should make one. You can use anything from highly figured stock to common shop scraps. To jazz it up, we laminated a turning blank from maple and cherry.

Watch a FREE two-part video on turning this project at woodmagazine.com/videos.

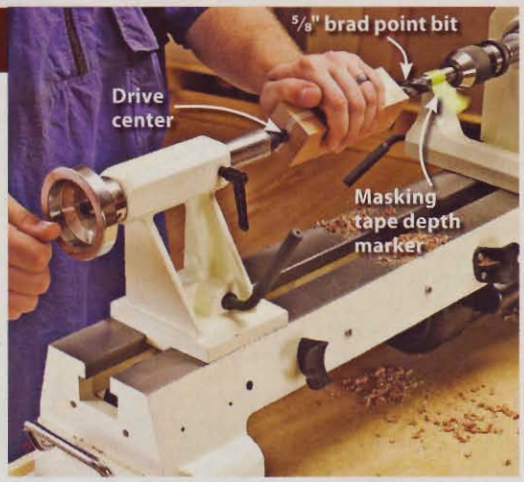
1 Gather the materials

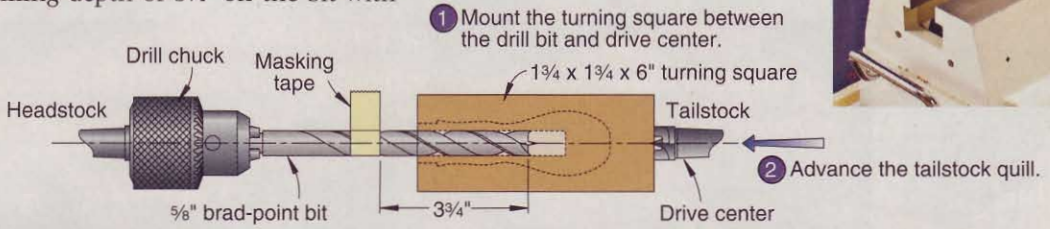
For this project, you'll need the materials shown at *right*. Laminate the 1¾×1¾×6" turning blank from one ¼×1¾×6" and two ¾×1¾×6" pieces of stock. To make the turning template, photocopy the **Screwdriver Handle** pattern on the *WOOD Patterns*® insert. Adhere the pattern to cardboard with spray adhesive, and cut it to shape with a crafts knife. See **Source** on *page 74* for the screwdriver hardware.

2 Drill the blank

Tools: Drive center, drill chuck, ⅝" brad-point drill bit.
Speed: 500 rpm.

Find the centers of the blank ends, and mark them with a center punch. Then mount the drill chuck with a ⅝" brad-point bit in the lathe headstock, and the lathe drive center in the tailstock. Mark a drilling depth of 3¾" on the bit with masking tape. Next mount the blank between the tip of the brad-point bit and the drive center. Now, holding the blank with your left hand to keep it from spinning, turn on the lathe, advance the tailstock quill with your right hand, and bore the hole, as shown at *right*.



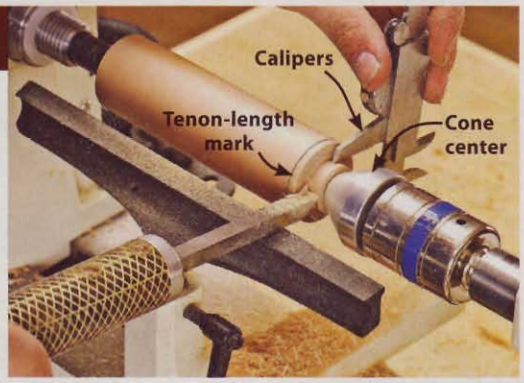


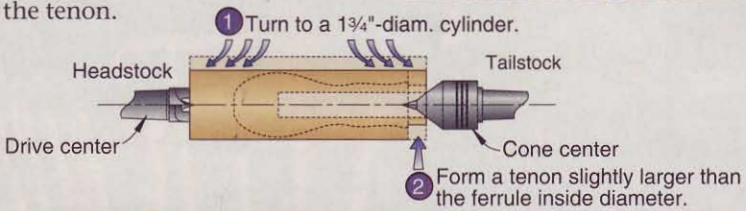
3 Turn the blank round and fit the ferrule

Tools: Drive center, cone center, spindle roughing gouge, parting tool, calipers.
Tool rest: Center.
Speed: 2,000 rpm.

Install the drive center in the headstock, and the cone center in the tailstock. (If you don't have a cone center, see the **Shop Tip**, *next page*.) Mount the blank between centers, inserting the cone center into the ⅝" hole. Then use the spindle roughing gouge to turn the blank to a 1¾"-diameter cylinder.

Measure the length of the brass ferrule with calipers. Then transfer this measurement to the tailstock end of the blank (the end with the ⅝" hole). Measure the inside diameter of the ferrule. Now make overlapping cuts with a parting tool, forming a tenon the same length as the ferrule and *slightly larger* than the inside diameter. Check the tenon diameter with calipers, as shown at *right*. Remove the blank from the lathe. Using a mallet and a wood scrap, drive the ferrule onto the tenon.



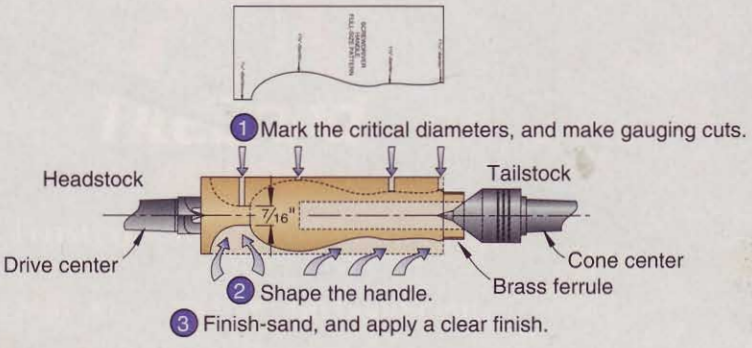


4 Shape and finish the handle

Tools: Parting tool, spindle roughing gouge, ⅜" spindle gouge.
Tool rest: Parting tool, roughing gouge: center; spindle gouge: slightly below center.
Speed: Turning, 2,000 rpm; sanding, 1,000 rpm; finishing 3,000 rpm.

Remount the blank between centers. Using the template as a guide, mark the critical diameters on the blank. Make gauging cuts with a parting tool. Then use a spindle roughing gouge, as shown *above right*, and spindle gouge to shape the handle, leaving a 7/16"-diameter neck connecting the handle to the waste. Don't worry when making cuts close to the brass ferrule. The high-speed steel tools will not be damaged if they graze the soft brass. Finish-sand the handle, and apply a clear finish. (With the lathe stopped, we applied several coats of mineral oil. Then with the lathe running, we burnished the surface with a paper towel.) Now use a parting tool to separate the handle from the waste.

Note: *A cloth rag used to apply a finish can get caught on the turning piece and cause injury. Always use a paper towel, which tears if snagged.*



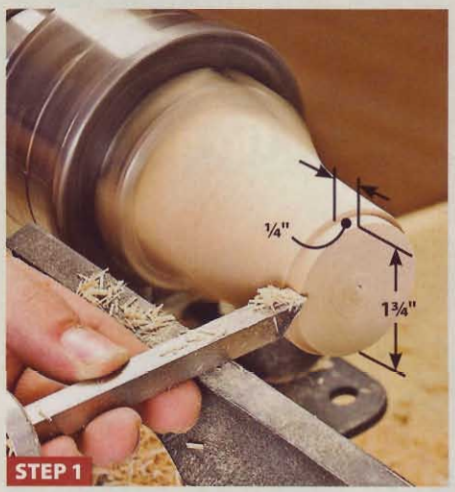
SHOP TIP

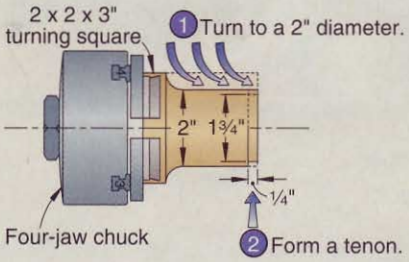
Convert a cup to a cone

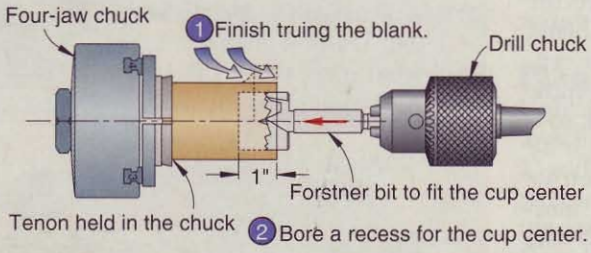
Most lathes come factory-equipped with a tailstock live cup center. But to hold a blank with the center drilled away, like the one in this project, a cup center won't work. You'll need a cone center. Rather than buying one, here's how to make a cone-shaped cap for your live cup center.

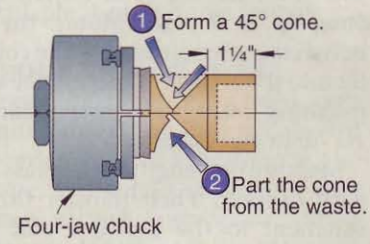
First cut a 2×2×3" block of hardwood. Then install a four-jaw chuck onto the head-stock spindle, and grip the block with the chuck. Use a spindle roughing gouge to turn as much of the block as possible to a 2" cylinder. Next use a parting tool to turn a 1¾"-diameter tenon ¼" long on the tailstock end, as shown *below left*. Reverse the block, gripping the tenon in the four-jaw chuck. Now finish turning the cylinder.

Install a drill chuck into the tailstock quill, and into the chuck, a Forstner bit slightly larger than the outside diameter of the live cup center. Advance the quill, and bore a 1"-deep hole into the cylinder. Then, starting 1¼" from the end of the blank, use a skew chisel to form a 45° cone, as shown *below center*. Part the cone from the waste held in the chuck. Now slip the cone over the live cup center and use it to hold the handle blank, as shown *below right*.



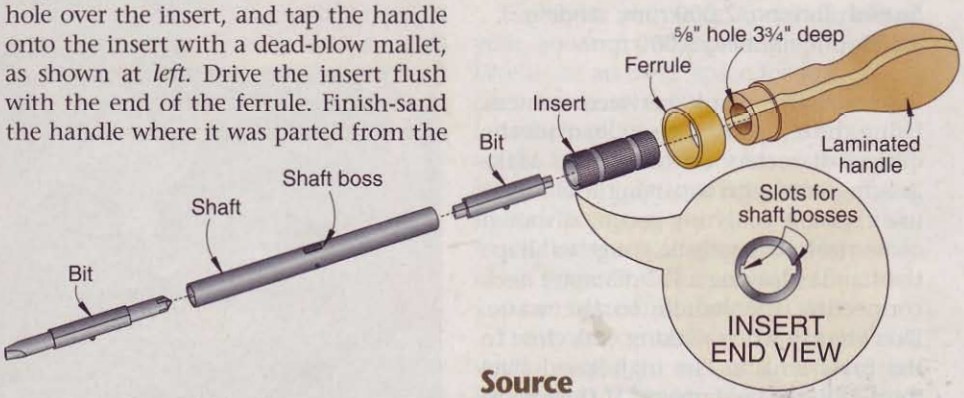



Four-jaw chuck
1 Finish truing the blank.
Drill chuck
1"
Forstner bit to fit the cup center
Tenon held in the chuck
2 Bore a recess for the cup center.



5 Drive in the insert

Place the insert plain end up (the end *without* the slots for the bosses on the screwdriver shaft) onto a hardwood scrap on your workbench. Position the handle hole over the insert, and tap the handle onto the insert with a dead-blow mallet, as shown at *left*. Drive the insert flush with the end of the ferrule. Finish-sand the handle where it was parted from the waste, apply mineral oil, and burnish. Snap the double-ended screwdriver bits into the shaft, and click the shaft into the handle, as shown *below*.



Written by **Jan Svec** with **Brian Simmons**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Source

Screwdriver hardware kit: 4-in-1 Screwdriver Turning Kit no. 37707, $6.79. Rockler; 800-279-4441, rockler.com.

Scrollsawn Greetings

Make handcrafted tree ornaments and matching cards at the same time. Then enclose the ornaments in the cards for unforgettable holiday greetings.

PROJECT HIGHLIGHTS

- Ornaments are 3⅜" to 4¾" high.
- Materials needed: ¼" medium-density fiberboard core plywood (we used birch and cherry), construction paper, safe-release masking tape, spray adhesive, crafts adhesive, .025" brass, decorative cord.
- Choose from seven full-size patterns on the *WOOD Patterns*® insert.

Skill Builders

- Learn the basics of stack-cutting in wood and soft metal, and how to make scrollsawn inlays.

Here's the basic recipe for making two identical holiday ornaments and matching greeting cards in one shot. The trick: Stack-cutting bundled layers of plywood yields two or more items from one sawing. Slipping in a couple layers of colored paper reaps additional dividends.

STEP 1 Cut two ornament blanks from ¼" birch MDF-core plywood and two 5×5" pieces of colored construction paper or card stock, and stack them together.

***Note:** MDF-core plywood ensures smoother void-free edges and a uniform color for a better overall look than ply-core plywood.*

STEP 2 Tightly wrap the stack with safe-release (blue) masking tape.

STEP 3 Make two photocopies of the ornament pattern of your choice on the *WOOD Patterns®* insert, and adhere one with spray adhesive to the stack.

STEP 4 Using your drill press, drill 1/16" or #60 blade start holes for the inside cuts. For the best appearance of the paper cutouts you'll use on the greeting card, drill the hole at a corner of each cutout.

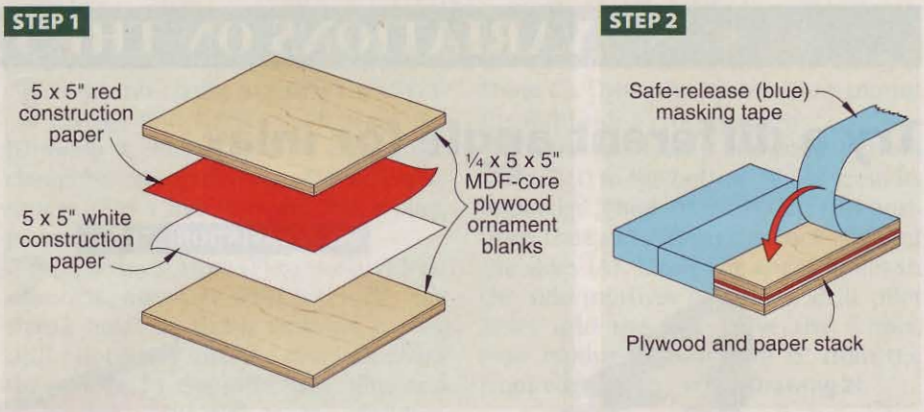
STEP 5 Make the inside cuts with your scrollsaw and a #2 (20 tpi) blade. Cut a careful, continuous path (no backtracking) along the pattern lines. As you complete each inside cut, carefully remove the plywood waste and paper. Organize the paper cutouts on the second pattern. Now cut the perimeter. To keep the plywood and paper sandwich together and the paper layers from shifting, make a continuous cut.

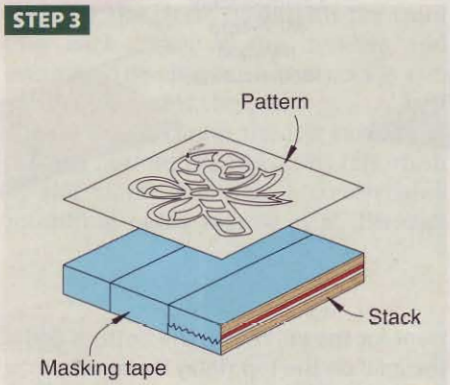
STEP 6 Separate the ornaments and paper outlines, and remove the masking tape and pattern. Finish-sand the ornaments, removing any fuzzy edges. Drill hanger holes, where shown on the pattern.

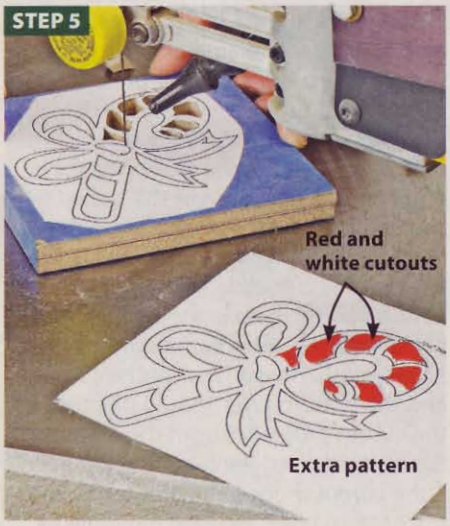
STEP 7 String the ornaments on a thin wire between uprights, and apply a clear finish. (We sprayed on satin lacquer.) With the finish dry, tie a loop of decorative cord through each hanger hole.

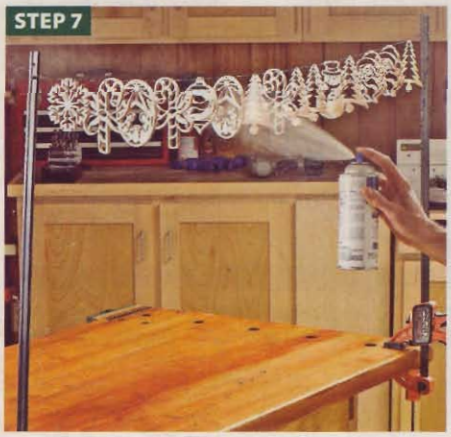
STEP 8 To make the greeting card, cut a 7×10" piece of colored paper and fold it in half to 5×7". Then adhere one paper outline and contrasting infill pieces to the front of the card. (We used Elmer's Craft Bond Photo Stik adhesive.) Discard the infill paper for the bow, letting the green background show through. For the example shown, you'll have two candy cane ornaments and two cards, one with a red outline and white infill and the other with a white outline and red infill.

STEP 9 Write your greetings on the card. If desired, add glitter decoration. (We adhered glitter with an Elmer's Craft Bond Memory Book Glue Pen.) Insert the ornament into the card, slip them into an envelope, and mail. (Before mailing, check with your post office for the necessary postage.)

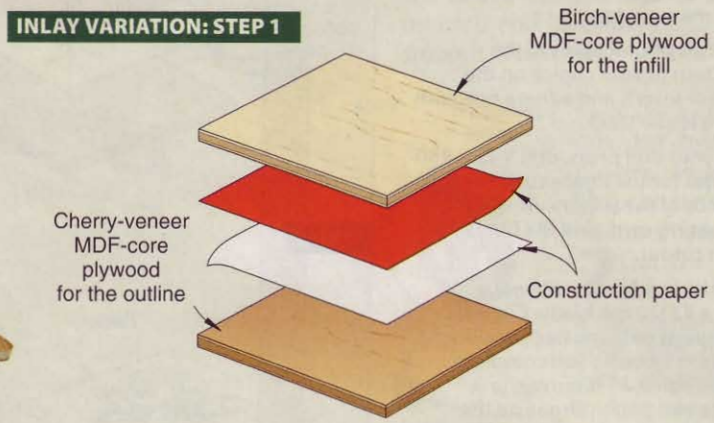

STEP 1
5 x 5" red construction paper
5 x 5" white construction paper
¼ x 5 x 5" MDF-core plywood ornament blanks
STEP 2
Safe-release (blue) masking tape
Plywood and paper stack







Try a different angle for inlay


INLAY VARIATION: STEP 1
Birch-veneer MDF-core plywood for the infill
Cherry-veneer MDF-core plywood for the outline
Construction paper

Instead of a fretwork ornament, you can make an inlaid one by stack-cutting two contrasting-color species and fitting the cutouts of one into the outline of the other. Using this method, you'll get one ornament from each two-piece stack.

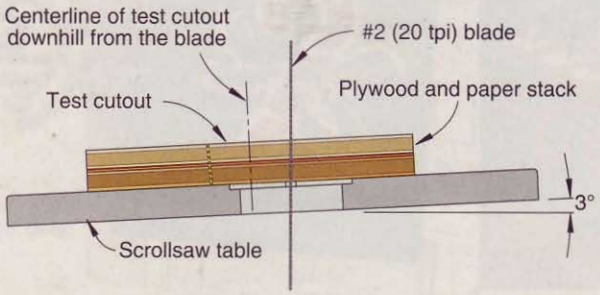
To eliminate the saw kerfs, simply tilt the scrollsaw table. This turns the cutouts into tapered plugs for an airtight fit between the parts. The thinner the blade you use, the less you'll have to tilt the scrollsaw table to make the cutout and outline surfaces flush, and the better the ornament looks from both sides. (The #2 blade we used needed only a 3° tilt.) With a slow feed rate and careful cutting, you can use this technique on almost any pattern, but you'll get the best results on designs with large, less-intricate cutouts like the tree, candy cane, and snowman. Here's how to modify the basic stack-cutting recipe.

In **Step 1**, use one piece of birch-veneer plywood and one piece of cherry-veneer plywood. Position the veneer color you want for the outline on the bottom and the infill on the top [**Inlay Variation: Step 1** *above*]. Make an extra plywood and paper sandwich from scrap for testing the tilt of the scrollsaw table. Proceed as instructed in **Steps 2** and **3**.

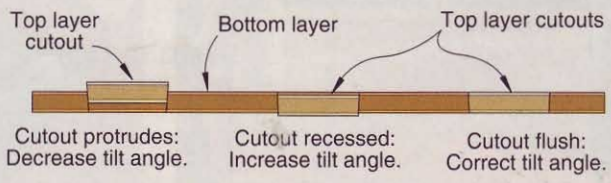
Before drilling the blade start holes in **Step 4**, draw a 1"-diameter circle on your test sandwich, tilt your drill-press table 3°, and with the center of the circle downhill from the bit, drill a blade start hole at the edge of the circle. Tilt the scrollsaw table 3° and cut the circle, keeping the center downhill from the blade [**Inlay Variation: Step 4a** *below left*]. Remove the cutouts and fit the top cutout into the hole in the bottom plywood layer [**Inlay Variation: Step 4b** *below right*]. The surfaces of the cutout and the bottom layer should be flush. If the cutout protrudes from the surface of the bottom layer, decrease the table tilt. If the cutout drops below the surface of the bottom layer, increase the table tilt. With a satisfactory fit, adjust your drill-press table to match the tilt of the scrollsaw table, and drill blade start holes for the ornament inside cuts with the center of each cutout on the downhill side of the bit. (Drill toward the center of the cutout.)

Moving to **Step 5**, make continuous inside cuts keeping the center of the cutout on the downhill side of the blade. (The perimeter of the cutout slopes inward all around.) The tilted table may cause the blade to drift to the uphill side of the pattern line when turning outside corners. Compensate by slowing your feed rate and applying slight pressure against the downhill side of the blade. Organize the *top* plywood layer and paper cutouts on an extra pattern. With all the interior cuts complete, return the scrollsaw table to the 90° position, and make the continuous perimeter cut. Then go on to **Steps 6** and **7**. Before finishing, glue the top layer plywood cutouts into the openings in the bottom layer plywood outline.

INLAY VARIATION: STEP 4a Make a test cutout.

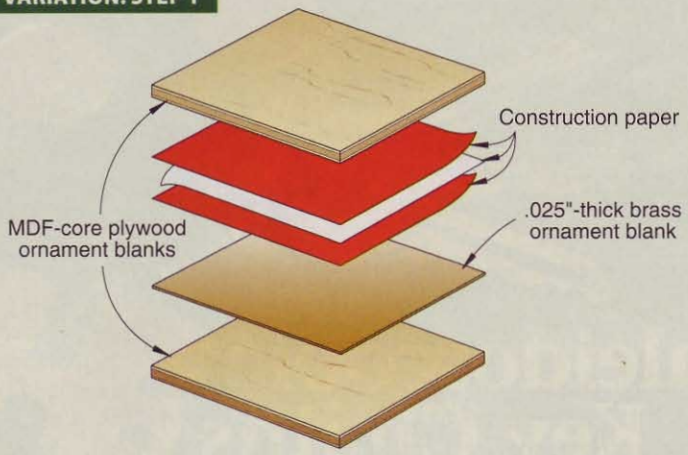


INLAY VARIATION: STEP 4b Test the fit.



Add a touch of brass

BRASS VARIATION: STEP 1



When scrollsawing thin soft metals, such as brass, copper, and aluminum, you must sandwich the metal between scraps of plywood or hardboard to keep the blade from catching the edges and distorting the workpiece. You usually discard the metal cutouts and all the wood, but a simple change to your stack yields two wood ornaments, one brass ornament, and paper cutouts for three greeting cards. Here's how.

In **Step 1**, sandwich one 5×5" piece of .025"-thick brass and *three* sheets of colored paper between the plywood ornament blanks [**Brass Variation: Step 1** *above*]. Then simply follow the remaining steps, cutting the ornament with a #2 blade and the saw running at high speed. When you remove the brass ornament from the stack, sand it to a uniform satin sheen with a 320-grit sanding sponge, and spray-finish it along with the plywood ornaments.

In memory of Pat Stouffer, designer
December 17, 1948–May 20, 2007

Written by **Jan Svec** with **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

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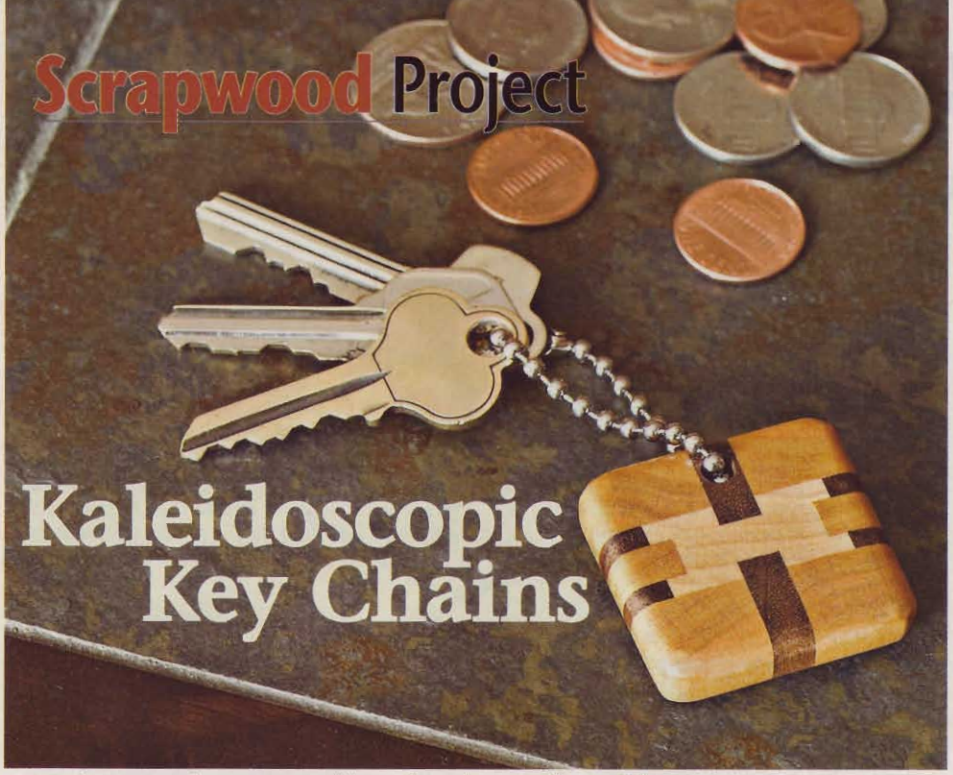


Make one for yourself and a dozen for gifts.

Turn your cut-off scrap into attractive key chains that will leave your friends and family wondering "How did you do that?" Tell them if you want to, but the secret lies in making a small "log" of multiple species; then cutting off slices.

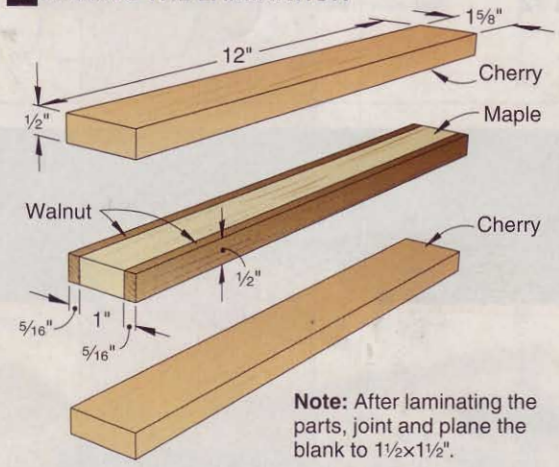
Form a scrapwood blank

1 Select three contrasting wood species; we used maple, cherry, and walnut. We also recommend beech, ash, birch, or poplar for the light color; alder, oak, mahogany, or bubinga for the medium color; and wenge, purpleheart, or ebony for the dark. We used 12"-long stock; that's the shortest you can safely run through a planer.

2 Machine your workpieces to the dimensions shown in **Drawing 1**, and laminate them as shown.

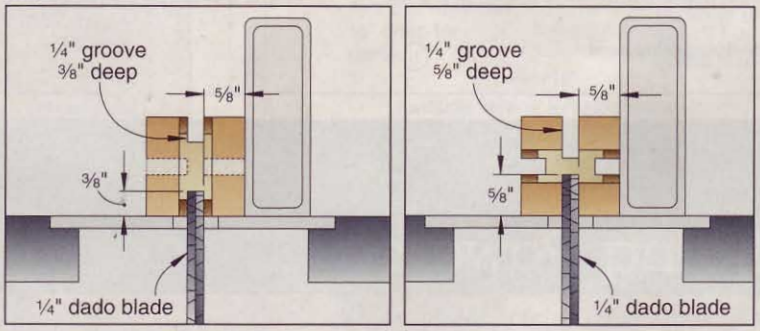
3 After the glue dries, square the blank on your jointer and plane to 1½" square, removing stock from both edges to keep the maple strip centered.

1 MAKING THE LAMINATION



Note: After laminating the parts, joint and plane the blank to 1½x1½".

2 CUTTING THE GROOVES



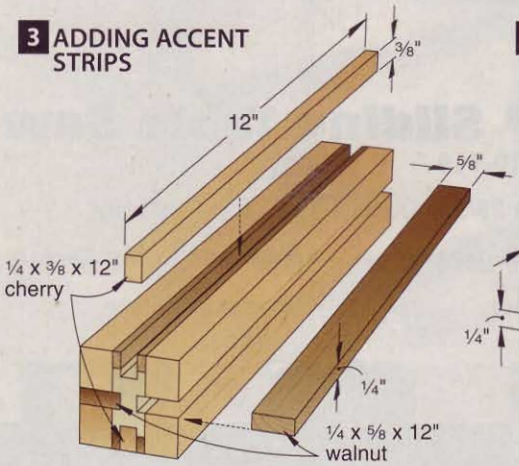
4 Using a router table with a ¼" straight bit or tablesaw with a ¼" dado set, cut grooves into your blank for the accent strips [**Drawing 2**]. (If you choose the tablesaw option, use blades with flat-tipped teeth. Blades with beveled teeth typically leave tiny triangular "ears" in the bottom of the groove.)

5 Machine cherry and walnut accent strips [**Drawing 3**], and glue and clamp them into the corresponding grooves.

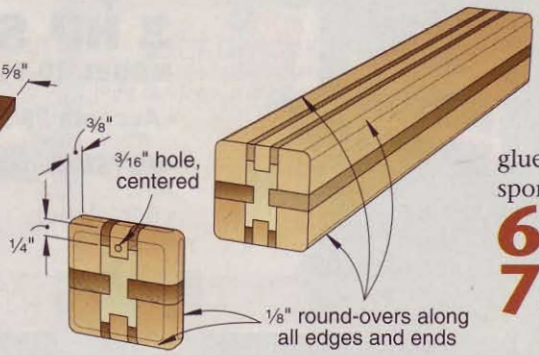
6 After the glue dries, sand the laminated blank smooth.

7 At your router table, rout ⅛" roundovers on all four long edges.

3 ADDING ACCENT STRIPS



4 CUTTING THE MEDALLIONS



continued on page 82

Scrapwood Project

Slice off medallions

1 Attach a wood extension to your bandsaw miter gauge, and clamp a stopblock to it ⅜" past the cutline. Use a 10-tpi blade for a smooth cut. After squaring the end of the blank, cut off ⅜"-thick medallions [**Drawing 4**]. Stop when the blank measures 3" long—it's unsafe to cut any more unless you clamp the blank to the miter gauge extension.

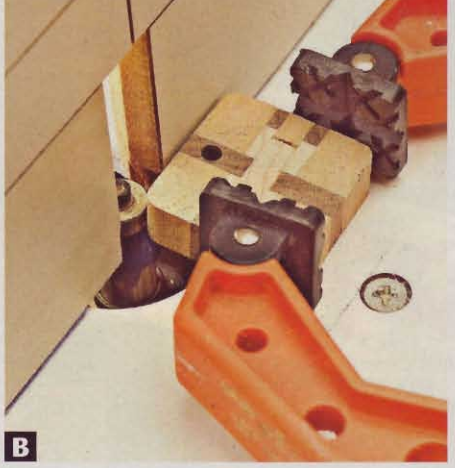
2 With a medallion slice secured in a clamp, drill a 3/16" hole [**Photo A**].

3 Using the same clamping technique, rout ⅛" round-overs [**Photo B**] on all edges of the medallion.

4 Sand smooth to 220 grit; then spray with three coats of satin polyurethane. Sand between coats with a 320-grit sponge. Hang the medallions on fishing line to spray them so you can do all sides simultaneously.

5 Cut a piece of beaded chain 4" long, thread it through the medallion hole, and couple it with a connector. Beaded chain and connectors are available at hardware stores and home centers.

A


B

For plans on making a second design, as shown, go to woodmagazine.com/keychain.

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Fuss-free faux through-tenons

Give a project the look of finely crafted through-mortise-and-tenon joints, without the hassle, by making these practical pretenders.

Sure, through-mortise-and-tenon joints look great. But they should, given the time you'll need to precisely cut and fit them. Here we'll show you how to install faux tenons to conceal an easy-to-make, screw-reinforced butt joint.

First, cut a shallow mortise

To rout a quick, accurate mortise, create a template from two pieces of ¾"-thick scrap. Each piece should be about half as wide as your router base and about 8" longer than the length of the mortise. To mimic a real mortise-and-tenon joint, make the mortise length ½" shorter than the part that will butt against the face opposite the mortise. The mortise width will equal the thickness of the part it complements.

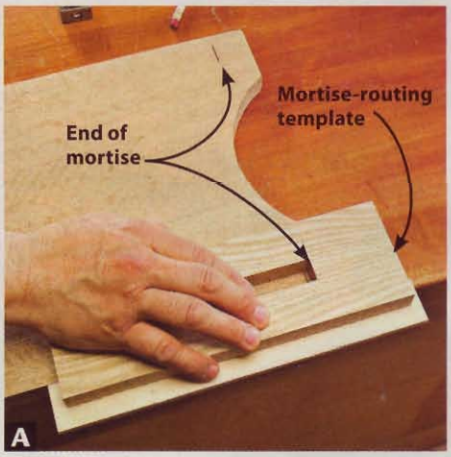
Divide the mortise width in half and make that dimension your dado depth. Then cut a dado as wide as the mortise length, as shown **[Drawing 1]**. Edge-glue the halves to make the routing template **[Drawing 2]**. Then attach a stop underneath to hold the template the correct distance from the workpiece edge.

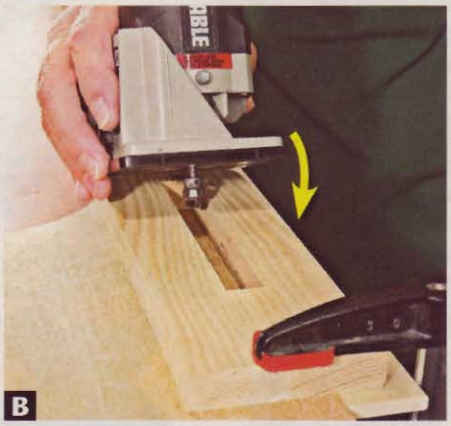
Pattern bit

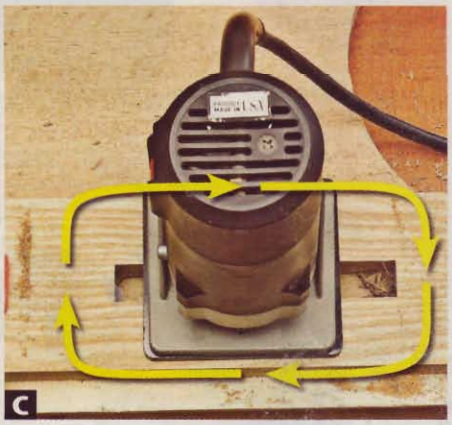
Clamp the ends of the template to a piece of scrap, and install a ½"-diameter, ½"-deep pattern bit, as shown at *near right* (see **Sources**), in your router. Adjust the depth-stop setting until the bit cuts ⅛" deep and the bearing rides against the sides of the template opening.

After marking the mortise ends on the workpiece, position the template with one end of the opening over an end mark **[Photo A]**. Carefully plunge the bit into the workpiece near the center of the template opening **[Photo B]**. Then cut the mortise by moving your router clockwise around the opening **[Photo C]**, with the bearing riding firmly against

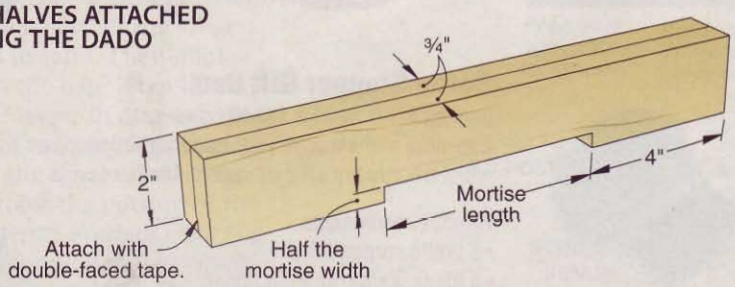
continued on page 86



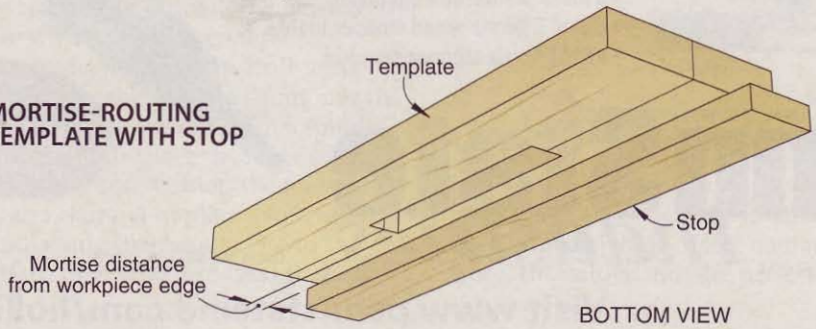




1 TEMPLATE HALVES ATTACHED FOR ROUTING THE DADO



2 MORTISE-ROUTING TEMPLATE WITH STOP



D

G

the sides of the template opening. Vacuum out the debris, and leave the template clamped in place.

Now square off the mortise corners using a ½" straight chisel or corner chisel (see **Sources**). Use the template as a guide to chisel dead-on 90° cuts **[Photo D]**. Repeat these steps to cut the remaining mortises on each workpiece.

Now cut the tenons

On the blank you'll use to make your faux tenons, rout 45° chamfers on all four sides at both ends **[Photo E]**, starting with the edges, followed by the faces to reduce tear-out.

Next, clamp a stopblock to your tablesaw fence, as shown **[Photo F]**, and adjust the fence to cut your tenons to the desired length. We made ours ⅜" long for a mortise ⅛" deep. Use a miter-gauge extension to reduce tear-out **[Photo G]**, and cut the tenons from both ends of your blank.

Test-fit faux tenons into the mortises, and sand them until they're snug. After you screw together the butt joint on your project, apply glue to the bottom of the mortise, and insert the faux tenon, as shown on *page 84*.

Cap drilled mortises with a rabbeted tenon

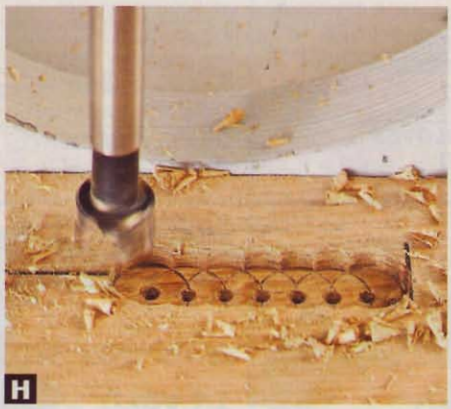
If you're more comfortable drilling mortises with a Forstner bit than routing them, here's a way to hide the mortise edges beneath the lip of a rabbeted tenon for a clean look. To start, mark your workpiece to show the mortise ends and centerline.

E

Next, install a Forstner bit as wide as the tenon thickness, minus ¼". Then position a drill-press fence so the bit spur touches the mortise centerline, and set the drilling depth to ⅛".

Drill holes at both mortise ends, followed by overlapping holes along its length **[Photo H]**. Using a straight chisel, cut the corners square **[Photo I]**, and remove as much of the scalloping along the edges as possible.

To make the faux tenons, cut a blank to the desired thickness and width, and chamfer the ends, as shown earlier. Set your fence for the distance you want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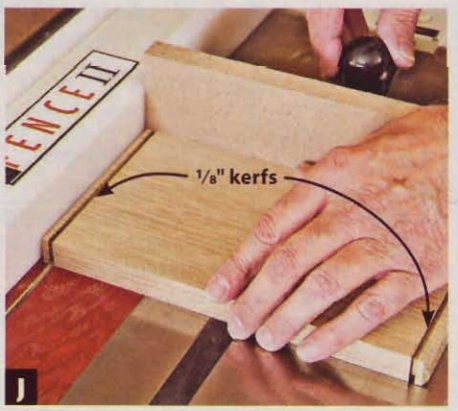

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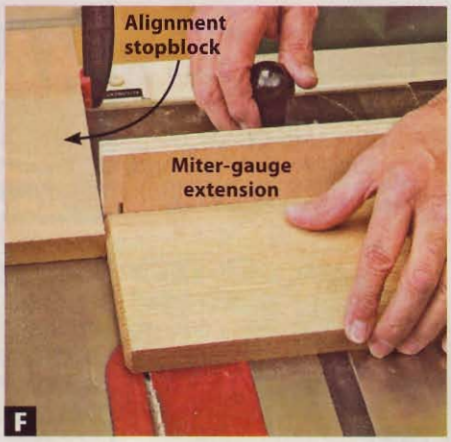


F

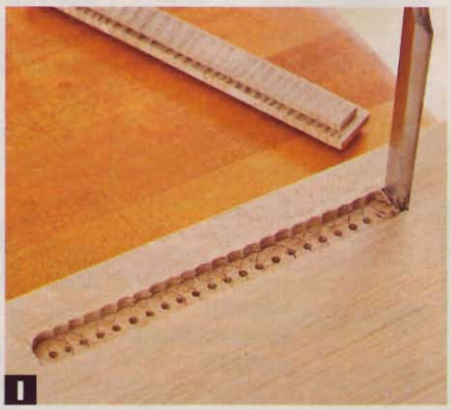
the tenon to extend above the surface of the mortise piece—¼" in this case—and cut ⅛"-deep kerfs on both edges and faces **[Photo J]**. Because you're not cutting completely through the workpiece, it's safe to use the fence in combination with a miter gauge.

Now slide the rip fence aside and attach a stopblock to the miter-gauge extension to cut off the faux tenon leaving a ⅛×⅛" rabbet **[Photo K]**. Check that the tenon fits snugly within the mortise, then glue it in place.

Sources

Pattern router bit. ½"-diameter x ½"-long bit no. 6509, $14.50, call MLCS at 800-533-9298; mlcswoodworking.com.

Corner chisel. Ray Iles 9/16" corner chisel, $56.95, call Tools for Working Wood at 800-426-4613; toolsforworkingwood.com.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K

Shop-Proven Products

These woodworking wares passed our shop trials

About our product tests

We test hundreds of tools and accessories, but only those that earn at least three stars for performance make the final cut and appear in this section.

Freud delivers above-the-table bit changes and adjustments

I've been building a new router table but hadn't decided which router to use in it. After testing Freud's FT3000VCE 3¼-hp plunge router, I knew it was the one for me. It's the first router to combine all of the features I want—electronic variable speed, above-the-table bit changes, and precision depth control—in a plunge router that will handle any bit in my shop.

The FT3000VCE delivers ample power, and the variable-speed control maintains consistent speed when I plow a bit into white oak or maple. Even though it weighs 13 pounds, this router doesn't feel top-heavy or tippy—like many 3-hp routers do.

I really like this router for table routing, though, because I can raise and lower the bit without a router lift. I like being able to make bit changes and height adjustments above the table, but be prepared: It takes 33 turns of the wrench to go from bottom to top. With my setup, it was 25 turns to get the collet high enough to change bits. That's a minor nuisance I can live with, offset by the tool's advantages.

The depth control proved unbelievably accurate. With a ⅜" straight-cutting bit installed, I routed a groove in a white oak board, changing the height in 1/64" increments. After each cut, I measured its depth with a digital caliper with readings to .001", and each time, the depth was right on the money. I got that same level of accuracy when using the FT3000VCE for hand-held work. The scale is easy to read, and depth adjustments are quick and simple to make.

—Tested by Steve Feeney

FT3000VCE plunge router

Performance	★★★★★
Price	$290

Freud
800-334-4107; freudtools.com

Titanium-top tablesaw proves its mettle against rust

I live in Iowa, where summers are hot, sticky, and dripping with humidity. So I find the titanium-nitrite-coated cast-iron top on Steel City's 3-hp cabinet-style tablesaw to be a huge advantage in my ongoing battle with rust.

To see how the rust-resistant tabletop compares with untreated cast iron, I moved this saw next to a new 8" jointer. Both got through the winter in fine shape, but when spring arrived, I began to see rust on the jointer—and nothing on the saw. To accelerate testing, I spritzed water onto the tops of both, even making a few small puddles, then let them sit for 24 hours. The result: rust where the water had been. The rust spots on the titanium-nitrite top wiped away with a clean cloth. No such luck with the jointer; it took a special cleaner to remove its rust marks.

This rust-inhibitive feature adds $250 to the price of Steel City's regular cabinet saw (model 35618). Sure, that's a lot of money, but to me, it's worth the peace of mind knowing I don't have to wax it regularly.

With or without the titanium-nitrite top, the left-tilting model (35640) is a superb tablesaw. It's also available in a right-tilt model (35630). With the heaviest and largest trunnions I've seen on a 10" saw, it's built like a tank. The large handwheels turn easily and the stops are dead-on, with no need for adjustment. The Biesemeyer-style rip fence and rails prove durable, accurate, and easy to adjust.

The throat plate has a red-paint finish that's dry but sticky, and it slows down workpieces when I push them through the blade. I replaced it with a maple zero-clearance plate. (Scott Box of Steel City said future throat plates will be powder-coated to cut friction.)

—Tested by Bob Hunter

10" 3-hp tablesaw, model 35640

Performance	★★★★★
Price	$1,600
Model 35618 (regular cast-iron top)	$1,350

Steel City Tool Works
877-724-8665; steelcitytoolworks.com

Kit provides inexpensive routed designs and inlays

For years I thought it would be great to rout or carve ornate designs or add intricate inlays to my projects, but I never took the time to learn the techniques. Milescraft's Design/Inlay Kit saved me the trouble. With this easy-to-understand-and-use kit and my plunge router, I was routing attractive designs onto surfaces in minutes. I also used the kit to create several inlays and their pockets and was pleased with how snugly they fit.

The kit features a two-piece base that snaps together, creating an enclosed sprocketlike center. You choose a design from the kit's manual, and then insert one of four templates (each with multiple designs) into the correct notches, as indicated in the manual. Finally, using the included router bits and guide bushings, you rout along the chosen cutout to craft your design. The guide bushings work only with the included universal subbase that fits almost any router. Also included: a ⅛" downcut spiral bit and a ¼" V-groove bit. So you don't ruin a good workpiece, you'll want to practice on scrap stock until you get the hang of it.

If you prefer to hand-carve or paint one of the designs, you can use a special guide bushing and pencil to simply draw the pattern onto your workpiece and then carve it with hand tools or paint it.

—Tested by Dean Fiene

Router Design/Inlay Kit, model 1207

Performance	★★★★☆
Price	$40

Milescraft
847-683-9200; milescraft.com

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Circle No. 1665

Right-angle Router-Table Push Pad

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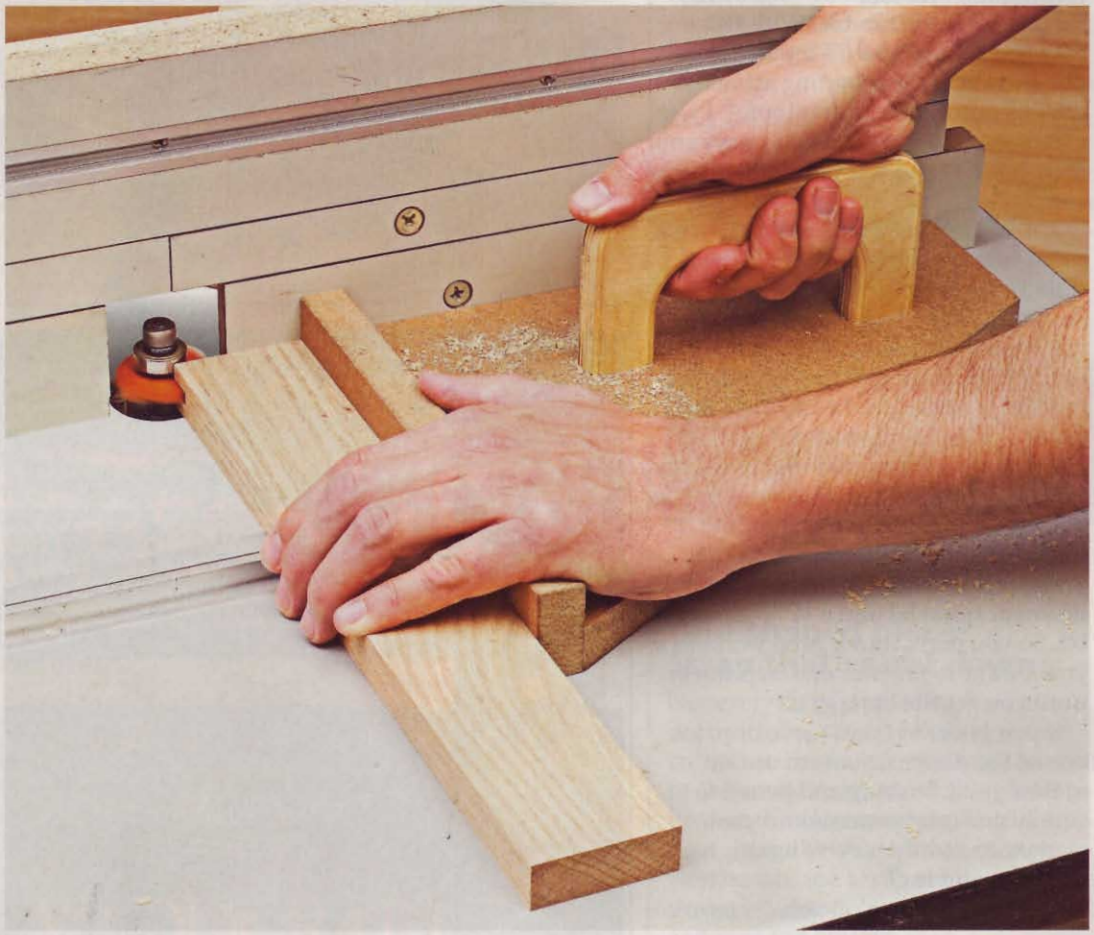
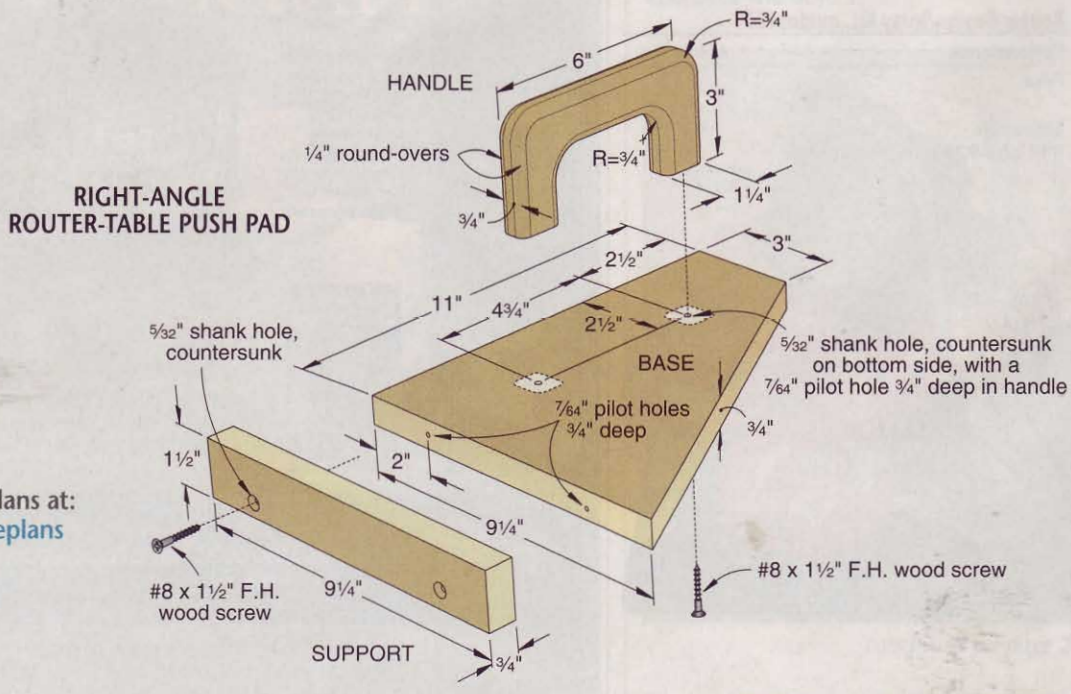
To build it, cut the pieces to the sizes and shapes noted on the drawing. Cut several extra supports so you can replace them as the inside end gets routed away. For a comfortable grip, rout the edges of the handle with a ¼" round-over.

Screw, but do not glue, the support to the base. Then, screw the handle to the base. Sufficiently countersink the screws securing the handle to the base so they don't scratch or catch on the top of your router table.



Project design: **Tom Clark**



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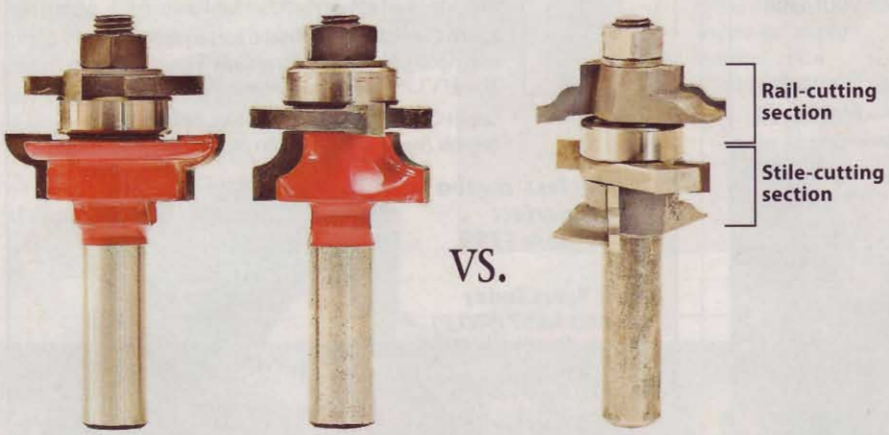


Rail bit | Stile bit | Combination bit

Divide rail and stile cuts for easier joints

Q • I've seen two router-bit • options for making rail-and-stile joints: matching bit sets and a single combination bit. It seems to me that the matching sets are the better way to go. Any thoughts?

—Greg Perlberg, Chantilly, Va.

A • We favor the two-bit method, • too, Greg. With two-bit sets, you make both cuts with the parts face-down on the router table. When you rout all the pieces face-down, you can sand out minor stock thickness differences from the back, leaving the front profile unaffected.

With a combination bit, though, you rout one profile face-down and the other face-up. Reversing the workpiece orientation this way may require you to sand out stock thickness differences from the front, throwing off the profile at the joints.

Also, with a combination bit like the one shown *above*, you'll need to take special care to keep hands away from the exposed upper portion of the bit when using the stile-cutting section.

Choose food-safe wood for cutting boards

Q • I'm going to make some cut-• ting boards, but I'm not sure which woods are food-safe. What can I use, and what shouldn't I use?

—Jessy McKenzie, St. Joseph, Minn.

A • For cutting boards that will be • used daily, Jess, stick with tight-grained domestic hardwoods, especially maple, birch, and beech. The small pores on these dense hardwoods leave fewer hiding places for foodborne bacteria than an open-grained wood, such as red oak. (Bamboo, actually a grass, offers another safe option.)

Lighter wood colors also work better than walnut, purpleheart, or other dark woods, where the color can leach out when wet. That's especially true if you use highly diluted chlorine bleach to sanitize your wood cutting boards.

Nail down the best brad size

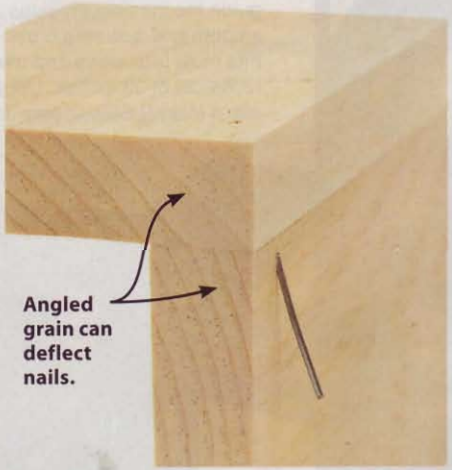
Q • I'm looking at buying a 15- or • 16-gauge finish nailer for my shop. From my experience, 18-gauge brads tend to follow the grain and blow out the side. Would 16-gauge nails act the same?

—Ronald Seto, Vancleave, Miss.

A • All three nail gauges can be • deflected by grain, Ronald. Instead, choose your nailer and nail length to suit what you're building and the materials you use.

To attach wide oak crown molding to a large project or in a room, use a 15- or 16-gauge nailer for added holding power. The tradeoff: You have to putty larger holes from the 15- and 16-gauge nailers compared to an 18-gauge nailer. For medium-size or tabletop projects, use an 18-gauge nailer or a 23-gauge pin nailer for even less puttying.

To lessen the chance of blow-out, choose the nail length that penetrates the top piece of wood and extends no deeper than 1" into the piece below. So for nailing ¾"-thick stock like that shown *below*, choose a nail no longer than 1¾". For safety's sake, even with shorter nails, never grip the wood with your fingers on either side of the nail's intended path.



Ouch! Blow-outs can deliver a painful surprise to fingers gripping the sides of the vertical board.

continued on page 94

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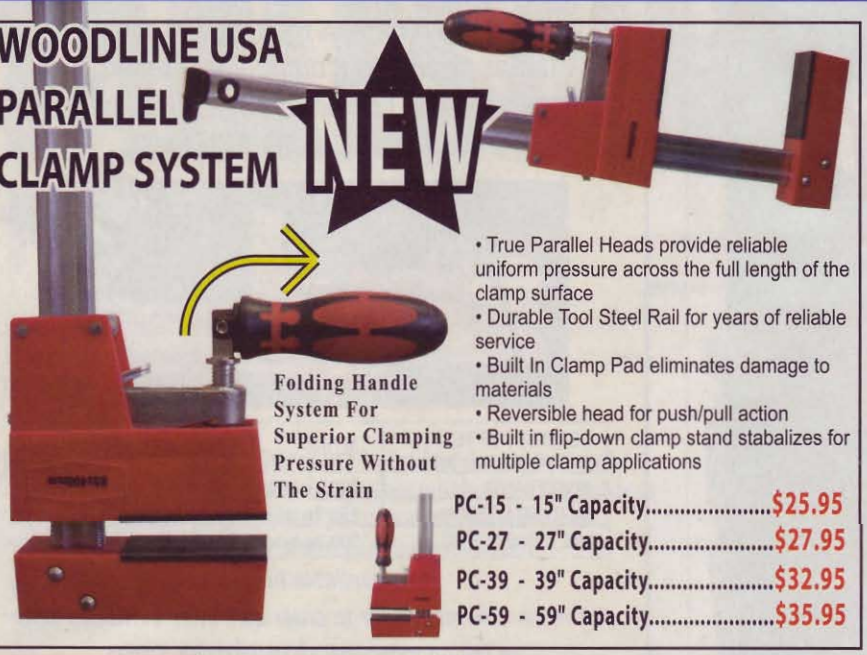

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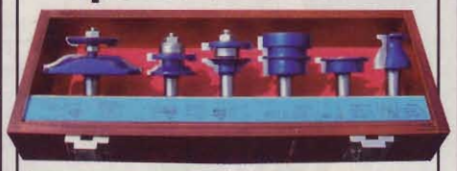

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Circle No. 310

Ask WOOD

Joinery as art

Q: While trying to salvage a canvas stretching frame that must be more than 100 years old, I encountered a miter joint I've never seen before. What is it called?

—Roy Gaines, Toccoa, Ga.

A: One of our joinery sources referred to a similar joint as a mitered mortise-and-tenon, Roy, or you could call it a twin mitered bridle joint. But the company that pioneered it, Tara Materials, calls it an interlocking tongue-and-groove joint. The joint was developed in 1875 by founder E.H. Friedrichs for the company's canvas-stretching frames. (It even was illustrated in a 1907 Fredrix catalog shown *below.*)

Today's version, shown at *bottom,* hasn't changed much from the original. The tongues in both pieces slide into corresponding slots, creating a frame that resists torquing out of shape from the stress of stretched canvas. The joint also provides plenty of surface grain for a solid glue bond, unlike a simple, unreinforced mitered frame, with its end-grain gluing surfaces.

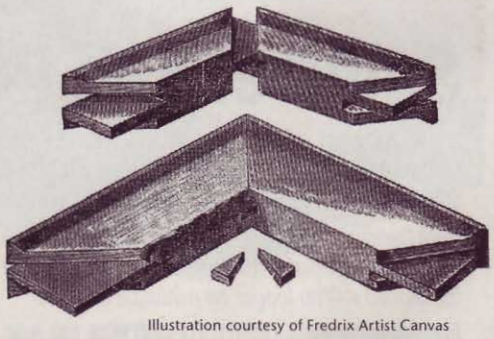
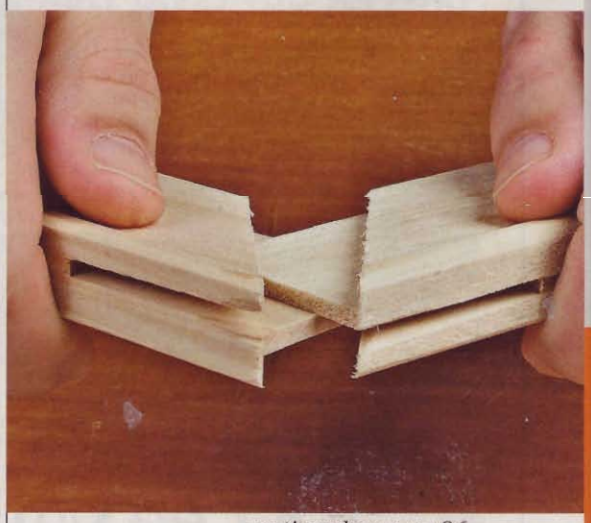


Illustration courtesy of Fredrix Artist Canvas



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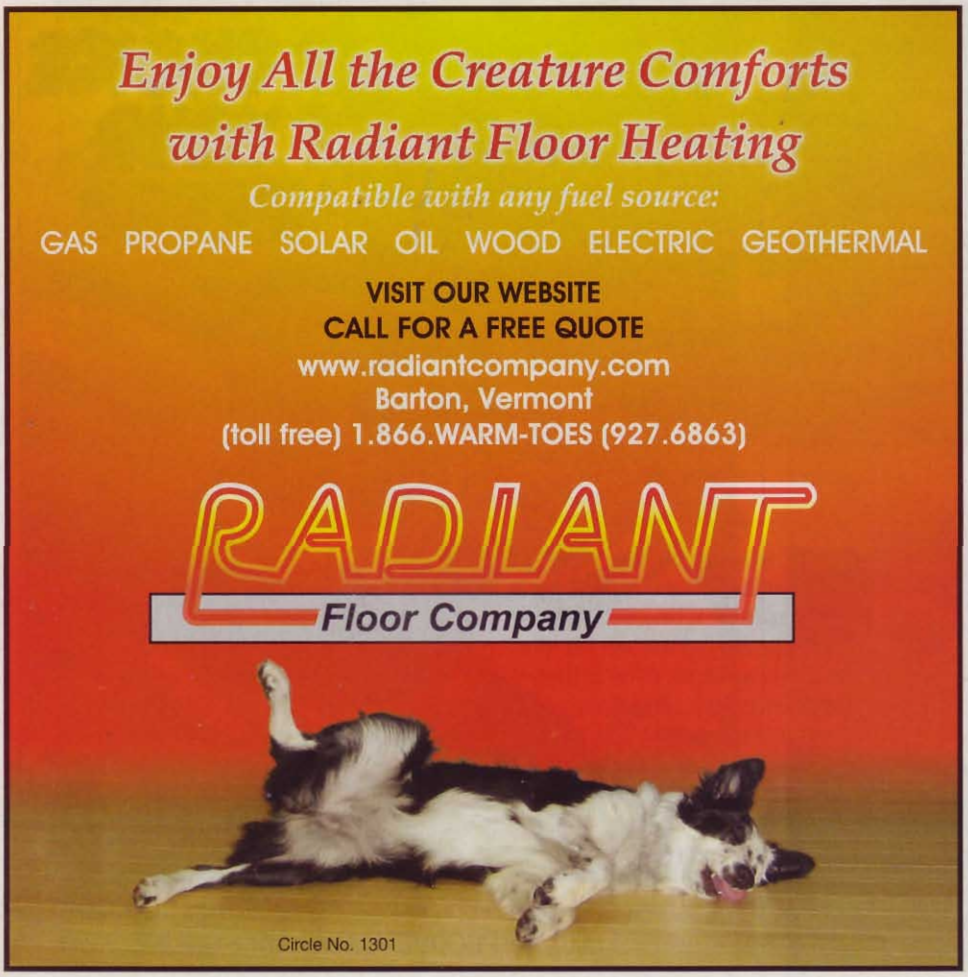


Circle No. 1301

Ask WOOD

Watts the difference?

Q: I purchased a used tablesaw that has the option to wire it for either 115 or 230 volts. My landlord, who pays the electric bill, says that wiring it for 230 volts will use more electricity. What are the pros and cons for either voltage?

—Rick España, Cherry Valley, Calif.

A: Your tablesaw's motor uses the same amount of electricity (measured in watts) regardless of the voltage, Rick. If you look at the plate on your saw's motor, similar to the one *below*, you'll see that as the voltage doubles, the saw uses half as many amps. For example, this contractor-style saw drops from 18 to 9 amps as the voltage doubles. Either way you multiply the combinations—115 volts times 18 amps or 230 volts times 9 amps—the power consumption remains 2,070 watts.

So why wire for 230 volts? Look at those amp numbers again. If you're pulling 18 amps on a 20-amp circuit, there's the chance of tripping a circuit breaker if your saw encounters an especially heavy load, or at startup, when it draws a brief surge of power. By switching to 230 volts, you relieve that strain on the circuit, doing you and your landlord a favor.

If your saw needs an extension cord 50' or longer, that's another reason to opt for 230 volts. The higher voltage encounters less resistance within the cord, delivering more power to your saw.

As for cons, a 230-volt outlet should be wired by a professional, and the breaker box may not have space to expand.

Plates attached to power tool motors will tell you your wiring options. This tablesaw motor uses 18 amps for 115-volt current or 9 amps for 230-volt current.

continued on page 98

Banish bad bandsaw vibes

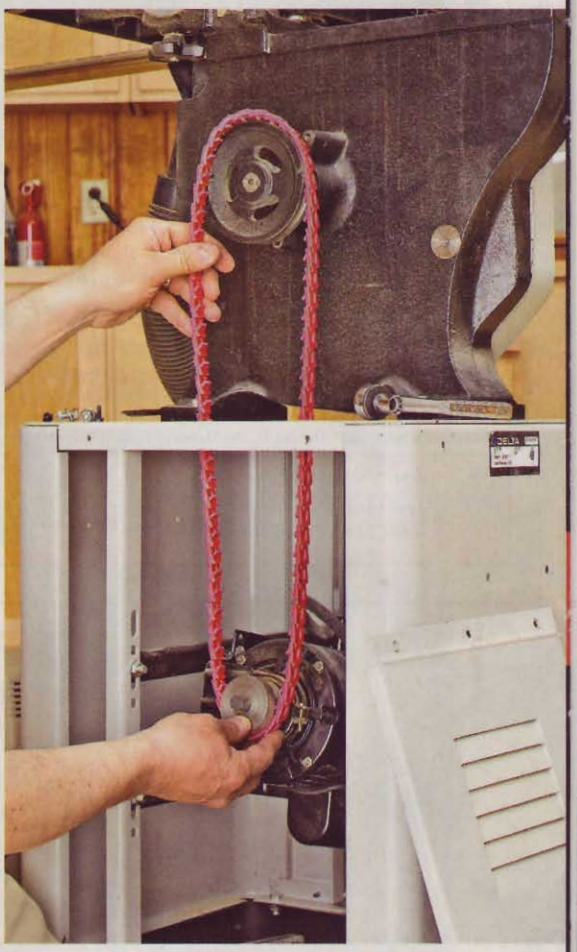
Q I just bought a 14" bandsaw that works beautifully and is accurate, but it has a vibration—a pulse every half-second or so. The pulleys line up correctly and the belt is tight, so I pushed a wooden wedge between the motor and the saw to tension the belt. That stopped the vibration, but did I do something horrible that will cause problems down the road?

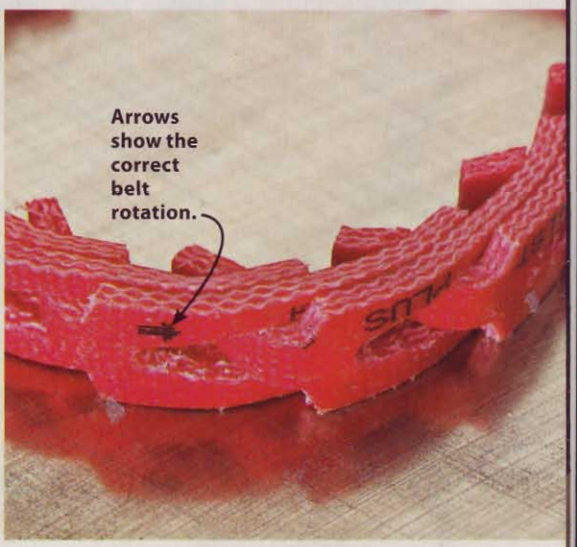
—Cary Chapman, Hemet, Calif.

A Horrible? No, but tensioning the belt with that wedge could stress the motor bearings, Cary, so you'll need another solution.

Belts can develop a kink from being tightly coiled in the saw's shipping carton, just as they can from being left looped around a small pulley wheel for long periods. Because it's a new saw, you could solve the problem by writing the manufacturer for a replacement belt. But if the problem returns, switch to a link belt, like the one shown at *right*, that doesn't develop such kinks when left in one position. (Order link belt no. 52233, $7.39 per foot, from Rockler Woodworking and Hardware, 800-279-4441 or rockler.com.)

To install it, just loosen the motor-mounting bracket to remove the old belt. Then shorten the link belt to equal the length of the original belt. Match the direction of travel stamped on the belt links, shown at *bottom*, to the direction the saw pulleys turn, and tension the belt according to the saw manufacturer's instructions.





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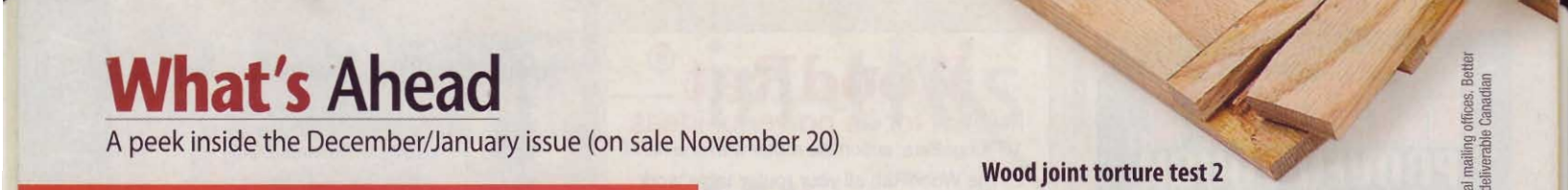
What's Ahead

A peek inside the December/January issue (on sale November 20)



Wood joint torture test 2
We made dozens of door and drawer joints, then destroyed them, so you'll know which ones are strongest.

FEATURED PROJECT

Mix & match modular cabinet system
Combine any of eight components to assemble everything from a small bookshelf to an entertainment center. Construction is super-simple.

Drop-leaf table
It seats two as shown *above*, or up to six with its leaves up. Turn the legs or buy them premade. And watch for a matching hutch in the March issue.

Presidential coin flag
This patriotic case holds a growing collection of the new coins honoring U.S. chief executives.

TOOL TEST

General-purpose tablesaw blades
Can one blade handle all your ripping and crosscutting tasks? We tested 30 of the best 40-tooth 10" blades in search of the perfect do-everything blade.

A fresh approach to box joints
Here's a twist on the traditional box-joint jig. It enables you to cut interchangeable box sides for easy assembly.

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